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ABSTRACT

Key issues in higher education management and finance in China until the end of the century are examined, along with the effect of recent education reform. Attention is directed to: the government's plan for long-term expansion of higher education posed as three alternative targets for enrollment growth; estimated demand for and supply of university graduates in the year 2000; projected demand for technicians and engineers in the year 2000; the recurrent cost structure of conventional universities; current practices in the planning, design, utilization, maintenance, and management of university facilities; school accounting; and the financial feasiblity of plans for developing higher education. Specific concerns include: the distribution of costs by category of expenditure, the relationship between unit costs and size of enrollment, and policies on student subsidies and cost-sharing. Data are included on: enrollment by type of institution; projected enrollment of conventional universities, 1983-1990; student expenditure per year on fees, textbooks, and materials; sources of revenues for operations; and expenditures by object. (SW)

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A WORLD BANK COUNTRY STUDY

CHINA

Management and Finance of Higher Education

HE 019 988

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A WORLD BANK COUNTRY STUDY

CHINA

Management and Finance of Higher Education

The World Bank
Washington, D.C., U.S.A.

The World Bank
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...Education must serve socialist construction, which, in turn, depends on education....

...The Communist Party of China Central Committee holds that, in order radically to change the current situation, it is first necessary to carry out systematic reform of the educational system....

...While reforming the administrative system and strengthening overall educational management, it is necessary to simplify administration and delegate authority by granting lower levels and academic institutions more decision-making powers....

...In promoting education, it is imperative to increase investment. For some time to come, the increase of educational appropriations by both central and local government must be greater than the increase of regular financial revenue... However, we must also realize that government investment in education is, after all, restricted by the level of its economic development... The solution to the problem requires us, through carrying out reforms, to harness more effectively...various social quarters to work with one heart and one mind in seeking more ways and means.

(From the Decision on Reform of the Educational System, May 29, 1985)

CURRENCY EQUIVALENT

The Chinese currency is called Renminbi (RMB). It is denominated in Yuan (Y)

Exchange Rates used in this report are as follows:

1980	$1.00	=	Y 1.50
1981	$1.00	=	Y 1.71
1982	$1.00	=	Y 1.88
1983	$1.00	=	Y 2.00
1984	$1.00	=	Y 2.00
1985	$1.00	=	Y 2.80
1986	$1.00	=	Y 3.20

FISCAL YEAR

January 1 - December 31

ACADEMIC YEAR

September 1 - August 31

ABBREVIATIONS AND ACRONYMS

CRTVU	-	Central Radio and Television University
GDP	-	Gross Domestic Product
GNP	-	Gross National Product
GVIAO	-	Gross Value of Industrial and Agricultural Output
SEdC	-	State Education Commission
SPC	-	State Planning Commission

CHINA

MANAGEMENT AND FINANCE OF HIGHER EDUCATION

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This report was prepared on the basis of a mission that visited China in June/July 1985. The mission consisted of Messrs R. Drysdale (Mission Chief), W. Middleton and W. Pierpont (Consultants). Ms. Ann Orr and Ms. Ivy Leung provided assistance in Washington. The work of the mission was aided significantly by close consultation and support by staff of the State Education Commission, Beijing. The mission expresses its thanks in particular to Madam Qin Tianyi Division Chief, SEdC Bureau of Planning and Finance for helpful support. A draft of the mission's report was submitted to the Chinese Government in January 1986 and discussed with the government in March 1986; this version of the report has been revised in light of government comments.

SUMMARY AND RECOMMENDATIONS

SUMMARY

1. This report looks at some of the key issues for China in the management and finance of higher education over the next 15 years and at options for addressing them in the light of recent education reform proposals in China and of international experience. It covers a range of topics including: a review of Government's plan for long-term expansion of higher education posed as three alternative targets for enrollment growth; broad estimates of possible demand for and supply of high-level manpower in function of different prospects for economic growth and structural change in the Chinese economy to the year 2000; an analysis of the recurrent cost structure of conventional universities including the distribution of costs by category of expenditure, the relationship between unit costs and size of enrollment, and policies on student subsidies and cost-sharing; an assessment of current practises in the planning, design, utilization, maintenance and management of university facilities; an evaluation of university systems of accounts for revenue and expenditure and of management organization; and, finally, an analysis of the financial feasibility of plans for developing higher education to the year 2000 under different assumptions with respect to internal efficiency and cost-sharing for university institutions. This section reviews the findings and where appropriate formulates recommendations on each of the above points.

2. Expansion of Higher Education. A chief goal of education policy in China is to achieve a significant expansion of higher education by the end of the century. This goal is based on two considerations: the proposal to increase aggregate enrollments in higher education to levels comparable to those of the middle-income countries and the recognition that the technical competence of the labor force must be raised if China is to achieve the economic status of a middle-income country by the end of the century and ultimately emerge as a modern industrial state. Turning to the strengthening of higher education within the program of Four Modernizations has been a justifiable choice. In the three decades since liberation China has addressed many major problems in the supply and distribution of primary and secondary education, and with notable success by comparison with countries of similar levels of income particularly in urban areas. By contrast the number of people with post-secondary qualifications, only 0.5% of the adult population, is very small. The goal for enrollment expansion in higher education has been examined by the Government of China and the World Bank in terms of three different plans based on different enrollment targets: low, an enrollment ratio of 10% by 2000 (or an average annual rate of increase of 10.4% from 1983); medium, an enrollment ratio of 12.5% (an average annual increase of 11.8%); and high, an enrollment ratio of 15% by 2000 (an average annual rate of increase of 12.9%). In order to reach the medium enrollment target of 12.5% rate of enrollment in 2000, the system of higher education would need to grow by about a factor of five between 1983 and 2000 (paras. 2.01-2.03).

3. A strategy in pursuit of this goal would necessarily follow three parallel tracks: (a) a sharp increase in enrollment in existing universities; (b) establishment of new universities; and (c) expansion of nonconventional approaches to higher education such as polytechnics, television universities,

correspondence, special and evening programs, and universities for workers, peasants and cadres. Based on current growth rates, the mission projects that regular higher education, including both conventional universities and polytechnics, and the television university system representing an innovative approach to higher education in China, will grow slightly faster than adult higher education overall. With 48% of total enrollment nonconventional higher education in China already holds a higher share of enrollment than in any other country. Despite the higher cost, emphasis by the Government on regular higher education, and the television university system, is explained by the priority for expanding full-time programs for future secondary graduates versus continuing education for adults. It also indicates recognition of the generally higher quality of education in the regular stream that has, along with television universities, received major new investments since 1979. Also about one quarter of those enrolled in adult higher education will enter correspondence, evening and special programs offered by conventional universities and polytechnics. In this way, these institutions will make more intensive use of their resources by increasing their role in specialized programs for mature students (paras. 2.04-2.17).

4. Enrollment growth must also be shaped to economic considerations including the demand for high-level manpower. At issue is whether rapid development of higher education will meet the broad human resource demands of rapid growth and substantial structural change in the economy. A related question is whether there will be an imbalance in supply and demand of graduates in key specializations. Planning of both the level and composition of expenditures on higher education in China is linked to manpower forecasting. However, projecting manpower requirements has proved problematic in numerous countries. Forecasts based on estimates of requirements provided by employers or on complex planning models have not been particularly successful. The difficulties of manpower forecasting in China are mitigated somewhat by the diversity of post-secondary education -- encompassing both the regular stream and adult higher education -- offering several routes to any given educational qualification. But the considerable diversity of higher education in China is offset to some extent by excessively specialized fields of study numbering in total several hundred. This narrow definition of field of study has been recognized by Chinese educational leaders as an obstacle to upgrading academic programs to the standard required and new, broader curricula are being introduced in major fields of study. This development also eases somewhat the task of projecting demand for manpower as future graduates will possess wider qualifications (paras. 2.18-2.23).

5. Despite the limitations inherent in any forecast, demand and supply projections that are revised periodically may provide insight into movements toward or away from balance. As a tool for planning, the direction of these movements is perhaps more important than the degree of imbalance shown by any single estimation. In illustration of a broad approach to projecting demand for high-level manpower, this report analyzes the three scenarios for expansion of higher education in relation to three alternative projections of economic growth and structural change in the Chinese economy using a multisectoral model. The three economic scenarios were developed in the recent World Bank report on the Chinese economy, China: Long-Term Issues and Options, Report No. 5206-CHA, World Bank 1985. One projection attains the Government's

target of quadrupling the gross value of industrial and agricultural output (GVIAO) between 1980 and 2000. Another projection maintains most of the assumptions made in the first case, but takes a less optimistic view of the future efficiency of China's economy and consequently projects lower growth. A third projection represents an alternative way of attaining the same growth rate of per capita national income as in the first case by giving greater weight to the services sector, specifically to commerce and miscellaneous business and personal services (paras. 2.25-2.26).

6. This comparison of enrollment projections with alternative scenarios of economic growth allows for several broad conclusions. The medium scenario for enrollment growth would provide more than sufficient graduates in the year 2000 under both the standard scenario to quadruple GVIAO and the lower economic growth scenario. It may not satisfy aggregate demand for graduates under the scenario of high growth rate of per capita national income with significant shift into the services sectors that are relatively more graduate-intensive in the use of labor. The high target for enrollment expansion would provide adequate numbers of high-level manpower in all three applications of the economic model. The low projections of growth in enrollment would generate adequate supply only in the low scenario of economic growth. Given the wide confidence intervals that must apply to projections of this kind, one should avoid too rigid an interpretation of these results. It may suffice to affirm that the medium enrollment target is reasonable in view of historic enrollment growth rates in China and elsewhere, and possible future demand for high-level manpower -- so long as China is content with a skill level of its labor force in the year 2000, as measured by educational attainment, that will be comparable to that of other East Asia economies such as South Korea and the Philippines in 1960 and 1970 (paras. 2.27-2.28).

7. Even at the low level of disaggregation of fields of study used in this analysis, however, there are differences among specializations in the adequacy of future output to meet demand in the year 2000. At present in China there is wide evidence of current or impending shortages in certain major fields of study. Information accumulated from enterprise surveys, interviews with municipal, provincial and national authorities, and information provided by SEdC and the Ministry of Labor and Personnel confirm that annual requests for qualified high-level manpower can be satisfied only in part. Shortages are particularly acute in scientific, technical and engineering fields, in management, including personnel trained in economics, finance, law and general administration, in health-related occupations and in education. The report reviews in a broad framework prospects for requirements of high-level personnel in engineering fields and in economics and finance as defined by the Chinese system of occupational classification, two areas that have recently received World Bank assistance. The projected supply of graduate technicians and engineers should satisfy demand under all three scenarios of economic growth and even allow for an upgrading of the educational level of engineering and technical personnel. There will be more of a problem of supply of professional and technical personnel in economics and finance -- occupations that include management, administrative and support personnel in the public service (including education), in state and collective enterprises, and in personal services -- where even the high scenario of enrollment growth would only meet the demand of a more service sector-oriented economy with

minimal upgrading of the currently very low educational qualifications of this group. This finding underscores the conclusion that in many specializations China will continue to depend on adult higher education (part-time studies and non-conventional delivery systems) as a substitute for regular full-time studies in the year 2000 (paras. 2.30-2.37).

8. Recurrent Costs. The analysis of recurrent costs in the operation of conventional universities in China focusses on two main areas of interest: the structure of recurrent expenditure by level and category of expenditure; and the effect of size of enrollment on unit recurrent cost, taking into consideration the kind of institution and changes in the student teacher ratio. Several conclusions are noted. On average personnel-related expenditure accounts for slightly more than one-third of recurrent expenditure. Although this level is well below the norm elsewhere -- in other countries personnel costs in higher education commonly run between 60% to 70% of recurrent costs -- policies that affect the deployment of teaching staff (about 60% of total personnel costs), such as an increase in the student teacher ratio, could still significantly reduce unit recurrent costs. By the same token, plans to improve remuneration of university (and education sector) personnnel, announced by the Government in mid-1985, would increase operating expenses but may be balanced by policies to increase the student teacher ratio (paras. 3.03-3.11).

9. The student teacher ratio in Chinese universities is low by comparison with other countries. The ratio for universities that provided data for this report is 3.7 to 1. The average for universities in East Asia and the Pacific, excluding China, is about 12 to 1. It is about 10 to 1 in Sub-Saharan Africa, 12 to 1 in the United Kingdom, 15 to 1 in the United States, and 25 to 1 in France. These conditions in Chinese universities derive from several historical factors that have now begun to change. For example, new hiring of faculty members is restricted; programs for upgrading faculty are in place; new policies for retirement are in effect; and planned teaching loads are increasing to a range of 15 to 18 hours per week. The State Education Commission (SEdC) aims to reach an average student teacher ratio in regular higher education of 8 to 1 by 1990 (paras. 3.12-3.13).

10. Another significant component of recurrent cost in universities in China is the cost of operating student residences, as well as assistance to students, such as fellowships, subsidies and food allowances, to underwrite some share of out-of-pocket expenses of attending university. These two items account on average for about 20% of recurrent expenditure. For those institutions operated by provincial governments (such as normal universities and comprehensive provincial universities), these two items add to 23% of total recurrent expenditure, largely because of higher subsidies for students in teacher education courses. These standards will be difficult, and perhaps inadvisable, to maintain over the long run in managing the expansion of higher education in China. Recurrent expenditure related to student boarding combined with various kinds of student subsidies increase recurrent costs and limit proportionately the capacity to provide more student places or to increase public expenditure on lower levels of education (para. 3.14).

11. Student residences are considered necessary by most university personnel, given average housing standards and the relative lack of alternative arrangements for students. But alternatives have proved possible in the case of polytechnics that provide no residential accommodations, and a few universities have already recognized that excess demand of qualified applicants could be satisfied by allowing students, as many as 10% in some cases, to make their own housing arrangements. In order to protect the interests of qualifed students from poorer families in any policy to limit university-supplied residential accommodations, available space could be allocated on the basis of need, as estimated by household income, coummuting distance and so on. At the same time, there are sound reasons to formulate new policies with respect to subsidies and grants to students. The promised reforms in pay policy will likely increase the material benefits that accrue to university graduates during their employment. Polytechnics, the television universities, and specialized courses of regular universities presently charge fees to students. And Government announced in May 1985 the intention to reduce student grants and subsidies, to charge fees for sponsored students and those admitted outside the state plan and to provide more scholarships to students based on merit (para. 3.15).

12. The social effects in China of an increase in the proportion of non-residential day-students and of greater sharing of costs by students (or their families and employers) are not entirely clear. A thorough-going analysis would require reliable data on distribution of income and on distribution of household expenditure by level of education attained, say, by the head of the household. It would also require estimates of future changes in income distribution as a result of changes in pay policy. To the degree that the experience of other countries is instructive, however, it deserves notice that public subsidies to education are quite often distributed inequitably. The relatively few individuals who are able to attain higher education receive very large unit subsidies compared to those who attain lower levels of education, and this, in the light of evidence that higher income groups are over-represented among those who attain higher levels of education. An important question concerns the equity effects of reducing subsidies or raising charges for higher education. In the absence of countervailing measures, it is possible that some poorer students would be forced to terminate their higher education programs; others will be discouraged from applying for university admission. It is generally recognized that such adverse effects could be mitigated through the increased provision of selective scholarships, as a source of financial aid especially for qualifed students from poor families, or through the eventual institution of educational loans (paras. 3.16-3.19).

13. In addition to questions of personnel costs and of student subsidies, the analysis of recurrent expenditure examined unit recurrent costs as a function of the size of institutions. It concludes that, even though the level of savings varies by the kind of university, there are substantial savings in unit recurrent expenditure in universities larger than the average size of 4,000 to 5,000 in China. Unit recurrent cost appears to decline or remain approximately constant after a much higher level of enrollment is reached, in the range, say, of 8,000 to 10,000. This may suggest that an enrollment level of approximately 8,000 to 10,000 could be the range of least

average unit recurrent cost beyond which the development of another institution could take place without much loss of efficiency. If, on considering capital expenditure on land, physical plant and equipment, particularly in the case of new institutions, an even larger size is recommended, there would be no significant loss in efficiency in terms of higher unit recurrent costs by exceeding the 8,000 to 10,000 threshold. The implications of this finding are quite clear. The planning of universities should give priority to expanding existing institutions or only building new ones with enrollments considerably larger than is currently the norm in China. Where smaller institutions operate in close proximity, say, in large cities, planning for future expansion should include the possibility of consolidating existing institutions under a single administration (paras. 3.20-3.21).

14. Capital Investment and Physical Plant Management of Universities. Efficient management of higher education concerns not only measures to reduce recurrent costs, but also to improve the productivity of capital investment in physical plant and equipment. The financial requirements for upgrading existing and building new facilities and for acquiring new equipment will compete with outlays for other pressing tasks such as faculty training, provision of educational materials, or development of library collections. These claims on available resources will force hard choices in allocating university budgets. They will also challenge higher education officials to re-examine some long-standing practices with respect to the planning and management of university facilities in a search for possible savings (paras. 4.01-4.03).

15. Planning of space requirements for universities in China has long depended on a system of per student space allocation. The report shows that comparison of these space standards for classrooms and teaching laboratories with space standards under World Bank projects in other developing countries, or in a set of comparator developed countries, suggests that the Chinese space standards could be reduced. The report estimates that, under the proposed shift to a credit system and an increase of about 25% in utilization of classrooms and laboratories, the per student space standard for classrooms and laboratories could be reduced significantly. This reduction could lower per student expenditure on facilities alone by about 20% (paras. 4.04-4.15).

16. The report also points out that, in the reformed environment for the development of higher education in China, the rigid application of per student space standards for facilities planning will prove inefficient. For larger and more diverse institutions, emphasis in design work should shift to a more micro-level approach of deriving accommodation requirements from analyses of specific educational and research needs. Design of university facilities should also incorporate certain improvements. These include among other things: more study hall or library reading room space to free classrooms for use in actual instruction rather than as areas for student study; more flexible, multi-purpose laboratories; and enhancement of comfort standards such as lighting, noise reduction, and so on (para. 4.16).

17. Beginning in the second half of 1984, the SEdC Construction Bureau initiated competitive bidding for construction projects, under which both local construction units and those from other areas would submit bids for projects. A prequalification procedure has been used to ensure that

construction units have adequate resources and experience. So far experience with competitive bidding for a few major projects in Tianjin and Shanghai has been salutary. Savings have been estimated at 10% and construction was realized on schedule. In other areas this approach has proved unfeasible because of the ongoing boom in construction and the present scarcity of materials and skilled labor. The quality of construction work varies greatly with some university projects receiving work below acceptable standards. One measure to help avoid this result is intensive supervision of construction by qualified university personnel (para. 4.17).

18. New design features as well as willingness to utilize space on a more continuing basis throughout the day would allow for increased space utilization. The achievement of higher levels of space utilization would undoubtedly require, however, centralizing responsibility for class scheduling and for classroom and most laboratory utilization in one academic office of the university. The use of computers could also simplify the scheduling and assignment process that may become more complex under a credit hour system as now proposed in many universities (paras. 4.18-4.26).

19. Management of teaching and research equipment has recently drawn the attention of SEdC, and new procedures have been established to improve equipment management, including maintenance. Insistence on the application of these procedures and on further strengthening of the systems at each university by measures such as establishment of testing and analysis centers, improved access to equipment for users from different university departments, and computer time sharing should be on the agenda of the SEdC Production and Supply Bureau (para. 4.27).

20. Maintenance and repair programs of many universities suffer from lack of budget and weak maintenance planning and procedures. Experience in other countries demonstrates that deferral of maintenance increases overall maintenance and repair costs exponentially. A survey of a few institutions by the mission indicated that the unfunded backlog of maintenance and repair as a proportion of plant replacement value was several orders of magnitude greater than is considered adequate in other countries. Moreover, in many cases maintenance management is weak with respect to preventive maintenance; regular inspection of facilities; the use of time and cost standards; and maintenance work planning. The SEdC Bureau of Construction could take a lead in monitoring facilities maintenance and repair programs and in developing standardized maintenance management procedures (paras. 4.28-4.31).

21. The report also finds that improvements in facilities planning and management require institutional changes, in both central agencies and universities, as well as opportunities for staff training and development. Within central agencies these changes include: strengthening the capacity of the SEdC Construction Bureau to develop revised space standards and more flexible design approaches for educational facilities; intensifying the work of the Laboratory Management Division of the Production and Supply Bureau of SEdC in development and dissemination of guidelines for teaching, research and administrative equipment utilization and maintenance; and establishing a new division, possibly within the SEdC Bureau of Construction, to monitor performance of and to provide assistance in developing systems for facilities maintenance and repair (para. 4.32).

22. Institutional changes in support of improved physical plant management within the universities include: consolidating all aspects of physical plant design, construction, operation and maintenance within divisions reporting to one senior administrative officer; increasing budgetary support and strengthening of management for facilities maintenance; and centralization of classroom and most laboratory scheduling and assignment in one officer reporting to a senior academic officer (para. 4.33).

23. Programs for training physical plant staff are needed to raise the standards and quality of physical plant management. The SEdC could assume a lead in this important function. Programs would include study visits abroad and to leading institutions in China for government officers and university personnel; development of training materials; and organization of workshops and seminars on a regional or national basis in China. In other countries this function may be served by a professional association, specialized committees of university officers or agencies within a ministry of education or a ministry of higher education. In China there is a present need for some analogous body to assume leadership in development and diffusion of innovations in higher education management. One possible solution would be the creation of a Higher Education Management Institute under the aegis of the SEdC or in cooperation with a leading academic institution with faculty competence in the area of higher education management (para. 4.33).

24. The report has identified one further, and possibly sensitive area, for long-term reform in university physical plant design and operations. It concerns the model of a self-reliant university common in China. In this style of operation, universities provide not only residences for students and necessary housing for faculty and staff, but also a range of other support facilities, and services. These include: primary and secondary schools for children of employees; substantial clinical and hospital facilities, and medical services; printing presses; stores; workshops; factories for equipment and other hardware production; and so on. The development of these auxiliary functions was a logical and necessary response to the economic environment of the 1950s and later. In particular, supply of faculty housing and related amenities by a university are an integral part of existing arrangements for compensation and benefits in China. However, in the reformed economic environment of the 1980s and beyond the continued self-provision of the full range of these facilities and services is questionable. They, of course, represent a significant share of total capital and recurrent expenditure. But the relatively small-scale provision by universities themselves, especially in view of possible supply of them by larger economic and social units, raises questions about the cost-effectiveness of current arrangements. Over the longer run, and once the supply of these services for university personnel and operations is assured by units external to each university, SEdC should examine carefully the justification for maintenance of these activities on many campuses and for their inclusion in plans for new universities (paras. 4.06 and 5.20-5.21).

25. University Fiscal Management. With the expected expansion of higher education to the year 2000, it is desirable to modernize university fiscal management procedures. The report has also identified several areas for change in university budgetary and expenditure procedures (paras. 5.01-5.02).

26. The financing of higher education has already diversified with major contributions by enterprises and non-educational agencies to university operations. Other sources of revenue -- student contributions, donations, as well as income from consulting and research contracts -- are increasing. In view of these developments, the report documents the need to improve accounting procedures for classification and monitoring of revenue. By the same token, improved university management requires more detailed accounting of expenditures. The current system records expenditure only under a system of classification by object. This is a necessary and important procedure. But its value is strictly limited in that the object classification does not allow for cost-accounting of different university functions -- academic programs; research activities; support services (as discussed in para. 24). Universities are about to receive greater autonomy in management of financial operations. This desirable change should be supported by development of improved accounting systems that incorporate a functional classification of revenue and expenditure in support of management of different programs and components of a university. The report presents and describes simple examples of such a system of accounts. In support of the transition to a programmatic or functional accounting in universities, several steps must be taken. New manuals for accounts and reports would have to be prepared, probably under the leadership of the Finance Division of the Finance and Planning Bureau of SEdC, and in coordination with the Department of Accounting Affairs Administration of the Ministry of Finance (paras. 5.03-5.25).

27. A system for university audits would also need to be established. This system would include internal university auditing to assist managers by way of a detailed review of implementation and effectiveness of the accounting and reporting system and of university financial operations. Audit reports for external purposes would assist SEdC, technical ministries and bureaus by providing a review of the application of uniform accounting and reporting procedures and of the accuracy, timeliness and usefulness of data provided by the university financial reporting system. The design and introduction of such audit programs would require inclusion of auditing procedures in a manual of accounts and reports (paras. 5.26-5.27).

28. University Organization. Another aspect of improved management of universities is the creation of more formal organizational structures. Prior to the current period of rapid development of Chinese universities, the organizational structures in place were simple, relatively informal and generally adequate. With the growth of universities and the more recent Decision on Educational Reform (May 1985), which will result in greater complexity and responsibility of universities, changes in internal organization are called for. This would require creating more clearly defined levels of responsibility and authority below the office of the president. Such a structure would be compatible with a budget and accounts system reflecting functional costs, would encourage the development of budgets from the lowest level up through each higher level of management, and would permit delegation of authority for university decision making, while maintaining accountability of operating units (paras. 5.28-5.29).

29. Many options exist as organizational models for university management. The report develops two generic types commonly used by universities in North America, Western Europe, Japan and many developing countries. The first describes an organization chart for a small but growing university; the second is more appropriate for a larger, more diversified institution. These two types are quite general and their application in specific cases would depend on a variety of local factors: number and kind of academic programs; size of graduate schools; range of research or consulting activities, and so on. The central feature of these types, however, is clarification of lines of authority and accountability for management of all aspects of university operations (paras. 5.30-5.35).

30. As with those responsible for management of physical plant, so for personnel responsible for financial operations, a substantial effort to improve knowledge and skills is required. Successful introduction of new systems and procedures requires that staff members in charge are given opportunity to take short courses, attend workshops, or join study tours for training in specific areas of management. Training of this kind for university finance personnel and other administrators could be organized by the Finance Division of the Bureau of Finance and Planning of SEdC, or a new Higher Education Management Institute that could assume responsibility for organizing, training, preparing training materials on these topics, and establishing relationships with corresponding agencies in other countries. The report also suggests that, as new systems are introduced in selected universities, these institutions could serve as models for others (paras. 5.36-5.40).

31. Costs and Financing of Higher Education. In the concluding section, the report reviews the level and trend of spending on higher education and attempts to assess, in broad terms, the financial feasibility of ongoing and planned expansion of higher education. The principal finding is that the medium growth target for higher education -- to an enrollment ratio of 12.5% by 2000 -- is basically feasible subject to two strong assumptions: first, that Government's plan to quadruple GVIAO by 2000 is realized, and, second, that there are significant improvements in internal efficiency and greater cost-sharing in higher education in an effort to reduce unit costs of public expenditure on higher education. The first assumption is beyond the scope of this study, but its realization has been judged as realistic in view of current performance and reform in the Chinese economy. The second assumption is central to this report. The conclusion reached here is that, in the absence of gains in internal efficiency and greater cost-sharing in higher education, there is a clear risk that the projected public costs of higher education could absorb too large a share of total public resources for education. Under such circumstances, much needed programs for improvement in the coverage and quality of basic education, in upgrading teacher education, and in the vocational and technical thrust of upper secondary education may not be financed (paras. 6.01-6.04).

32. The report reaches this conclusion by two steps. First, by use of the three projections of the multi-sectoral model of the Chinese economy, public spending shares on education overall are projected for the year 2000. Second, public unit cost of higher education in the year 2000 is projected according to three different packages of policies on internal efficiency and

on distribution of financing of higher education. These are used to generate public expenditure on higher education in the year 2000. These results are compared with the overall levels of spending on education projected from the economic growth model. In the case of the medium target for enrollment expansion, the report includes analysis of the implications for public expenditure on higher education and on all education. Comparison of these results is also made with those obtained for the low and high enrollment targets (para. 6.05).

33. The three different packages of policies on internal efficiency and distribution of financing to be achieved by the year 2000 are defined as follows. In the first package, salaries and related personnel costs are assumed to increase in line with the Government's goal for GDP per capita. But there are no departures from current practice in the internal allocation of resources to education or in cost-sharing arrangements. In this case, the student teacher ratio, student residential accommodation and other student subsidies, and unit capital costs are all held to standards of 1983. In the second package, the same adjustment is made in personnel-related costs as in the first case. But there is added: a policy to double the student teacher ratio; to increase teachers' remuneration by 50%; and a savings in unit capital costs of 20% by means of adjustments in design standards and improved levels of space utilization. In the third package, all of the above changes are incorporated, but adjustments in cost-sharing are added. These include: a decision to enroll up to 30% of full-time students in conventional universities as day students; management of tuition fees and other charges, balanced by scholarships, so that net income reaches 10% of unit recurrent cost in conventional universities and 20% in the polytechnics; and correspondence, special and evening programs are operated so that 50% of recurrent cost is recovered from sponsoring work units. The directions of these policy changes are consistent with statements of SEdC and the recent Decision on Educational Reform. The actual percentages chosen in this simulation are, of course, only judgments by the mission of what may be reasonable (paras. 6.06-6.08).

34. The results of these calculations in the case of the medium plan for enrollment growth are instructive. The 1983 share of public expenditure on education as a share of GNP is about 2.2%. The estimated level of public expenditure on higher education in 1983 is about 25% of total public expenditure on education. In the year 2000, the level of public expenditure on education as a share of GNP is projected in the economic growth model to increase to between 3.0% and 3.4% in the three projections of the multisectoral model, an increase in relative terms of between 36% and 64%, though still lower than the East Asia and Pacific average of about 4.0% in 1980. Although these projected increments in public expenditure on education are already substantial, to the extent that comparative data for other countries are relevant for China, somewhat higher shares for public educational expenditure may still be possible. In the absence of such additional increases, if there is no improvement in internal efficiency or gain in cost-sharing, under the medium enrollment scenario, the share of public expenditure on education devoted to higher education would rise sharply. It would reach between 33% and 49% depending on the economic growth scenario, much higher than the 1983 share of 25%. The 1980 average for East Asia and Pacific is 18.5%; among industrialized countries about 19.1%. If the second package of reforms of internal efficiency is introduced, under the medium enrollment

scenario by the year 2000 the share of the public educational expenditure on higher education would still rise above 25% to between 27% and 42% depending on the economic scenario. If reforms in internal efficiency and in cost-sharing are both introduced, the share of public educational expenditure on higher education would be 23% in the case of a quadrupling of GVIAO, 35% in the low economic growth scenario, and 24% in the projection of growth in the economy that includes a greater shift into services. Under circumstances of quadrupling GVIAO or of equivalent growth in per capita national income with greater weight to the service sectors, combined with gains in internal efficiency and cost-sharing, the share of public expenditure on higher education would be just below the current level and closer to the averages in the region or among the industrialized countries. The greatest volume of additional public resources would then be available for other programs of educational investment (paras. 6.09-6.12).

35. The report does not consider in detail the financial impact of the low (10% enrollment rate) or high (15% enrollment rate) scenarios for enrollment growth. The implications of these alternatives are, however, relatively clear by reference to the medium target for enrollment growth. The high enrollment growth scenario would require an increase of about 25% in public expenditure on higher education in 2000 above the level projected for the medium target. The report concludes that this level would be beyond the financing capacity of Government under any of the three scenarios of economic growth or packages of reform in internal efficiency and cost-sharing. In contrast, the low enrollment target would require about 20% less public resources than the medium plan. If implemented in tandem with reforms in internal efficiency and cost-sharing as identified in the report, the low enrollment target would reverse the trend since 1979 of a rising share of public educational resources devoted to higher education (para. 6.13).

36. The report concludes, however, that along with plans to quadruple GVIAO enrollment by the year 2000, there are strong reasons for otherwise pursuing the medium growth scenario. At that level of participation in higher education, requirements for high-level manpower could be broadly satisfied. Likewise, at that level of participation, China would approach the educational standards of the middle income developing countries. It would also be in a stronger position to emerge as a modern industrial state in the next century. There are, of course, other pressing claims on public resources for education. Some of these priorities, such as nine year compulsory education, a significant increase in the share of secondary students in vocational and technical programs, and new investment in teacher education, will themselves require substantial increases in levels of public expenditure It is unlikely that goals for these other educational programs would be achieved if public spending on higher education takes a share which significantly surpasses historical levels for China or levels allocated to higher education in other countries. Accordingly, this report suggests that there is, in effect, a tradeoff between the medium target for expansion of higher education and other desirable educational goals. The analysis of the medium enrollment scenario signals clearly the need for improvements in internal efficiency and of greater cost-sharing in higher education if this scenario is to be financially feasible. In the absence of firm measures in these two areas, enrollment growth would have to be curtailed (para. 6.14).

Recommendations

37. Information obtained in the manner of this report for a country of the size and diversity of China may prove unrepresentative. Forecasts, however careful, are often wrong; lessons of international experience may be ambiguous; and certainly, comparisons are hard to apply to China. The findings of this report should be understood, therefore, as an attempt to contribute to discussion and debate on management and finance of higher education and, as such, are subject to modification and adjustment. Only from this perspective, the mission has formulated a number of recommendations based on findings. These are listed below keyed to the related paragraphs in the main body of the text.

38. In broad terms, among the three targets for enrollment growth discussed between educational officials in China and the World Bank, the mission finds the medium enrollment target of a 12.5% enrollment rate in 2000 a reasonable goal. It is reasonable, however, only if public expenditure on education continues to increase to a share of GNP closer to levels of other countries of East Asia and if difficult choices are made substantially to increase the internal efficiency of higher education and to distribute a somewhat larger share of the cost to students, families and employers. In the view of the mission, prospects for gains in internal efficiency and for greater cost-sharing would improve if the following recommendations in management and finance of higher education are implemented:

(a) Under the medium enrollment plan, the demand for high-level manpower would be broadly satisfied. But Government should maintain regular, short-term analysis of manpower supply and demand to gauge the adequacy of output in relation to demand within specific fields. The report finds that, in line with current policy, expansion of programs for technicians and engineers may proceed slightly below planned rates of growth for higher education overall. The report also concurs with Government's plans for expanding enrollment in economics, finance and related fields as preparation for management, administrative and support personnel at a higher rate of growth than is planned for higher education overall (paras. 2.29-2.31).

(b) With respect to recurrent expenditures the mission recommends several measures:

(i) universities should seek to raise substantially the student teacher ratio. The current level of about 3.7 to 1 should increase to at least 8 to 1 by 1990, the official target. But levels of 12 to 1 are standard elsewhere and should become the ultimate target for universities in China (para. 3.13);

(ii) Government should reduce the level of student subsidies in higher education while increasing selective support for qualified students from needy families. The intention to pursue this goal has already been announced by the Government in May 1985. Specific measures include: reduction in residential accommodation where alternatives are possible; application of fees to students able to pay or to those sponsored by work units; and award of scholarships to qualified students unable to finance studies A reasonable target for the year 2000 may be for 30% of full-time students in conventional universities to be enrolled as day students and for 10% of recurrent costs in conventional universities and 20% in polytechnics to be financed by fees and charges. At least 50% of recurrent costs in correspondence, special and evening courses should be recovered from employers (paras. 3.14-3.19); and

(iii) Government should encourage universities to operate with much larger enrollments, at least twice the current average size, in view of the likelihood that larger institutions can be operated more economically. Enrollments in the range of 8,000 to 10,000 full-time students would be reasonable in mosts cases and should become a medium-term target for institutions where specific restrictions, such as limitations on available land, stringent building codes or related factors, do not apply (para. 3.20).

(c) With respect to physical plant planning and management, the mission recommends that:

(i) space standards should be lowered to levels that are seen as acceptable for public universities in other countries. Classroom and laboratory space, in particular, could be reduced, parallel to the introduction of the credit system and measures to increase the level of utilization of facilities. At the same time, space standards should be applied in the future more as guidelines than as design specifications. In general, greater flexibility and diversity are called for in university design (paras. 4.10-4.17 and 4.36);

(ii) several improvements in design should become standard in all programs for major expansion of existing universities or development of new universities: more study hall or library reading space should be provided in order to free classrooms for actual teaching use; universities should plan for more flexible, multi-purpose laboratories; and new buildings should incorporate improvements in lighting, noise reduction and other comfort standards (paras. 4.17 and 4.37);

(iii) further gains are required in the level of utilization of classrooms and laboratories. Increase in utilization would result if universities centralized scheduling and assignment of classrooms and laboratories under one academic office and, in the future, made greater use of computers for this task (paras. 4.25, 4.26 and 4.38);

(iv) the SEdC Production and Supply Bureau should continue to strengthen guidelines, and its capacity, to monitor university equipment management. More attention is required to achieve greater use of centralized testing and analysis centers; to improve access to equipment for users outside the department housing the item of equipment; and to increase sharing of computer facilities among all sectors of the university (paras. 4.27 and 4.39).

(v) SEdC should encourage universities to allocate a larger share of recurrent expenditure to facilities and to equipment maintenance and repair. The SEdC Bureau of Construction should prepare guidelines as well as standardized procedures for maintenance management (paras. 4.28-4.32 and 4.40);

(vi) SEdC should encourage universities to consolidate all aspects of physical plant planning and management within divisions reporting to one senior administrative officer (paras. 4.33 and 4.41); and

(vii) SEdC should adopt a long-term goal of reducing the number and scope of support services that universities provide directly for themselves. In the design of new institutions, proposals for hospitals, schools, printing presses, factories and other facilities to be included as part of the university operation, should be subjected to rigorous analysis of the cost-effectiveness of self-provision versus the option of purchasing these services from outside the university campus (paras. 4.05 and 4.35).

(d) With respect to fiscal management and university organization, the mission recommends that:

(i) new systems of accounts for revenue and expenditure should be developed in order to improve university cost accounting. These systems should be based on a functional approach to accounts classification so that revenue and expenditure can be assigned and evaluated by functional area (paras. 5.14-5.22 and 5.43);

(ii) SEdC, in coordination with the Accounting Affairs Administration of the Ministry of Finance, should encourage each university to create an internal audit unit and should organize a program of regular external audits of university accounts (paras. 5.26-5.27 and 5.43);

(iii) in support of new accounting procedures, the Finance Division of the SEdC Finance and Planning Bureau should develop manuals for accounts and reports. The manuals should include accounts and reports for budgetary, accounting and reporting purposes. The manual should also include reports for purposes of internal and external auditing (paras. 5.23-5.27 and 5.43); and

(iv) universities should formalize their management organization to create more clearly defined levels of responsibility and authority within separate operating units. Examples of models are contained in the report and could be adapted to the specific needs of each institution. The new organizational structures should be compatible with a budget and accounts system reflecting functional costs (paras. 5.28-5.35 and 5.44).

(e) Finally, SEdC should consider establishing a Higher Education Management Institute as a focal point for university management staff training and for development of new practices in university management and in financial operations. The proposed Higher Education Management Institute could organize programs of management training, prepare training materials and establish relationships with corresponding agencies in other countries. Working through such a body, SEdC would be able to promote much needed staff development for university administrators in all areas of physical plant and financial management. Such training could take the form of study tours abroad, workshops, and visits to selected institutions in China that have introduced new management approaches (paras. 4.32, 5.37, 5.40 and 5.45).

I. BACKGROUND

Recent Developments

1.01 China's ultimate economic objective is to catch up with the developed countries, while maintaining a socialist system in which the benefits of prosperity are widely shared. Major, though uneven, progress toward this goal was made in the past three decades. During the next two decades, there could be substantial further progress, laying the foundations for rapid and equitable growth in the next century.

1.02 The Government has set targets of quadrupling the gross value of industrial and agricultural output (GVIAO) between 1980 and 2000 and increasing per capita national income from about $300 to $800 (about 5% per year) in constant prices over the same period. The World Bank has recently concluded that quadrupling GVIAO would require an investment of about 30% of national income.[1] This is comparable to the rates in other fast-growing East Asian economies, as well as East European countries, and in line with China's past investment. With progress in efficiency of investments in social and economic infrastructure, and provided that the population in 2000 is close to the official target of 1.2 billion people, quadrupling GVIAO would allow the Government's per capita income target to be attained.

1.03 It is generally recognized that the drive for economic development to the end of the century depends on how successful the economy is managed. This is not only a matter of importing and developing technology and of mobilizing both financial and human resources, it is also a matter of achieving greater efficiency in investments, in the sense of reducing costs, increasing productivity, and of allocating resources to those sectors and projects with the highest returns. This demands foresight, flexibility, incentives and, no doubt, modification of some long-standing practices and patterns. In recognition of these preconditions, the Government has announced and introduced a series of economic reforms in recent years. These reforms began on a national scale with the introduction of the peasant responsiblity system in agriculture in about 1979. Under this system, the individual household has replaced the collective as the basic unit of farm management and production. Since October 1984, the reforms have also affected the urban economy with a general loosening of controls over enterprises, greater freedom in pricing and related decisions and a number of financial reforms designed to increase financial flows for investment.

1.04 In the first four years of the Sixth Five-Year Plan, 1981 to 1984, the success of these adjustments in economic management has been impressive. Since 1981 agricultural output has grown by 50% in current prices; rural incomes are up 60% on average; industrial output 45%; and the commercial sector by 100%. Over that same period prices across the economy rose only about 20% altogether. In 1984 the overall growth performance was the best of recent years. Real gross domestic product (GDP) increased by 14%; real gross output value in agriculture was up by 12%; industry grew by 16%; energy production increased by about 10%; transport by about 12%; and commerce jumped by as much as 20% depending on the measure. The impact of recent policy changes has been so explosive and so widespread that, in the medium term, some intervention is necessary to prevent overheating of the economy or troublesome fiscal or external imbalances.

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[1] See China: Long-Term Issues and Options, Report No. 5206-CHA, World Bank, 1985.

1.05 To sustain rapid growth over a longer period, to the year 2000 or beyond, requires more than the rapid growth stimulated or released by the loosening of state controls. It is a hard and complicated task that depends on numerous factors -- not the least of which is the development of human potential through investments in education and training.

1.06 The Government of China recognizes that people are both the means and the ends of economic development. Their numbers, knowledge and skills, effort and initiative will largely determine the pace and pattern of China's development. This primacy of human resource development is evident in China's achievements in education since 1949 -- unmatched among developing countries of the same income level: two-thirds of China's adult population is literate; the secondary enrollment ratio, 35%, is higher than in countries with comparable levels of income; adult education has been widespread; and in many respects quality of higher education has been high and, at its best, of international standard.2/

1.07 That is not to say that educational development has been without problems. China's education system has suffered from numerous problems: discontinuity in planning and policy; uneven development of basic education; a structure of senior secondary education that leaves the majority of those entering the labor force without specialized preparation; and a decline in coverage and quality of higher education from 1965 to about 1980 as a consequence of the disruption caused by the Cultural Revolution.

1.08 In recognition of these deficiencies in education, the Government has brought educational policy under the purview of ongoing system reform. A series of actions are now proposed that recognize the need for policy and institutional change in education if this sector is to be "a motor rather than a brake" on development in the years to come. The guide to policy adjustment in education is found in a recent Decision on Educational Reform, announced in May 1985.3/ In five main sections, this document announces that:

2/ China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, op. cit.

3/ Decision on Educational Reform, Beijing, May 1985.

(a) the purpose of the (educational) reform is to improve the quality of the nation and produce more qualified people;

(b) responsibility for developing basic education will rest with provincial and lower level administrations, and the goal is to implement in stages a nine-year system of compulsory education;

(c) the structure of senior secondary education will be adjusted in favor of a higher proportion, about 50%, enrolled in vocational and technical education;

(d) in institutions of higher education, enrollment plans and graduate assignment will be adjusted to allow for greater flexibility; and higher education institutions will have greater autonomy in the management of programs and resources; and

(e) in order to strengthen leadership in the education sector, the State Education Commission (SEdC) has been set up to replace the former Ministry of Education and is responsible for controlling general educational policies and guidelines, mapping out an overall plan, coordinating the work of various departments in education, and providing unified guidance for reform.

1.09 As with the reforms in the urban and rural economies, which place a premium on improved economic management, so this announced package of adjustments in educational policy rests on improved management of the education system. A unifying theme in both areas of system reform -- economic and educational -- is to seek efficiency in the use of resources through delegation of responsibility within a planned and coordinated framework; flexibility in implementation; and incentives for improvement of management performance.

1.10 According to the Decision on Educational Reform, under the leadership of the Party, SEdC is responsible for overall guidance of higher education, defined as all "policies, decrees and plans of the state." A three-level system of management and finance -- namely at the central level (one third of all institutions) and the provincial and major city levels (remaining two thirds) -- exists to implement and monitor state higher education policy. Accordingly institutions of higher education may be operated and financed by SEdC, by education departments of central ministries or by provincial and municipal departments. These latter may be called, for example, provincial departments of education or of higher education depending on the degree of specialization. SEdC (and the Ministry of Education prior to May 1985) develops norms and standards for both academic and administrative functions. In the past this has resulted in relatively uniform courses of study, similar academic standards and common practises with respect to personnel management, budgeting and general university administration. Since 1978 university admission has been managed under a central admission examination. Qualified students have been enrolled in institutions within an overall plan developed jointly by SEdC and the Central State Planning Commission (SPC) and worked out in coordination with education departments of central ministries or provincial and municipal administrations. Assignment of graduates has likewise been managed by SEdC and SPC with first claim on graduates' services exercised by sponsoring departments. Students enrolled in national institutions (under SEdC or other central ministries) would be assigned nationally. Students enrolled in provincial institutions would be assigned within their own province. Academic degrees are recommended by each institution, but control on conferral of degrees is ultimately held by the State Council through an Academic Degree Committee. Although policy and guidelines are set by SEdC under the leadership of the Party, adult higher education has functioned with less central guidance. Administration of adult education, however, remains a similar three-tier structure with students enrolled in institutions operated by education or adult education departments of central ministries and provincial or municipal governments. The rapidly growing television university system is managed by both SEdC and provincial governments.

1.11 This system of relatively tight administrative control, especially that exercised over the network of greater than 900 regular academic institutions, is likely to change quite significantly as a result of the 1985 reform decision. Change is in the general direction of greater autonomy for academic institutions. Newly authorized functions of universities include: authority to revise and introduce new courses of study within various disciplines; authority to engage in research projects and develop consulting and other arrangements of technical assistance; greater authority in allocation of available resources for operations and capital development; authority to appoint or remove university personnel; the power to enroll students at employer's request and qualified students at their own expense in addition to students enrolled under the state plans. At the same time preferences of students will be given greater consideration within the system of job assignment. SEdC and operating departments will continue to provide overall policy guidance, finance and inspection. Various units within SEdC, in particular, will be called upon to develop and revise guidelines for academic and management services of universities and to provide or arrange for technical assistance to universities seeking to introduce new or improve teaching programs and to modernize their management systems.

1.12 The subject of this report is management and finance of higher education -- the subsector of highest priority for the Government in education since the Cultural Revolution. Deficiencies in higher education have been a central focus of China's educational strategy since about 1979, and great efforts have been made to improve academic standards, expand enrollments and plan for further substantial enlargement over the next 15 years. Turning to the strengthening of higher education within the program of Four Modernizations has been a justifiable choice. In the three decades since Liberation China has addressed many major problems in the supply and quality of primary and secondary education, and with notable success by comparison with countries of similar levels of income, particularly in urban areas. By comparison with other developing countries, however, the number of people in China with post-secondary educational qualifications -- only about 0.5% of the adult population -- is very small. In 1979, enrollment in higher education was about 3% of the age group, in 1983 this share reached 4%. In a group of middle income developing countries, the enrollment ratio in higher education was about 12%; in the East European nonmarket economies about 20%; and in the industrialized market economies about 37%, all in 1982.[4] Full-time enrollment in four-year universities in China was only 1.0 million in 1979. It had grown to about 1.2 million in 1983. This figure could reach between 5.2 and 7.6 million by the end of the century. Adult higher education, that includes the television university system, part-time studies and enrollment in specialized institutions for workers, peasants and staff, was approximately 500,000 in 1979, as many as 1.1 million by 1983. Enrollment in adult higher education is estimated by the mission to grow to between 3.7 and 5.6 million by 2000. The number of universities has grown apace. There were about 630 in 1979 and 900 in 1985. SEdC expects that the number of university institutions will continue to increase to the year 2000 with increased enrollment accommodated both in new institutions and in new facilities added to existing institutions. Incremental resources (both recurrent expenditure and capital investment) for higher education will be substantial. The World Bank estimates that annual recurrent expenditure for higher education could grow from about Y 3.0 billion in 1983 to between Y 12.1 billion and Y 16.9 billion in 2000, that additional equipment requirements could reach about Y 3.4 billion more from 1983 to 2000, and additional investment in physical facilities, about Y 22 billion more (all in 1983 prices).[5] These are large sums especially in view of per student recurrent expenditure in universities in China, about US$715 in 1983 or 2.2 times GNP per capita (and about 15 times the average unit expenditure at the secondary level and 40 times average unit expenditure at the primary level).

1.13 Major educational issues in the development plans for higher education in China have been analyzed in government reports and World Bank documents.[6]. These include: analysis of academic programs; improvement in curricula, experimental work, and academic support services such as computer centers, audio-visual centers, test and analysis centers, and libraries; demand and supply of teaching faculty and faculty upgrading; development of teacher education; and expansion of graduate programs. A gap remains in a detailed and analytic review of issues in management and finance of higher education. Institutional capacities and financial constraints effectively determine the implementation of educational objectives. In the light of ambitious enrollment plans and the substantial investment required, failure to attend to management and finance issues could easily jeopardize the achievement of long-term goals for higher education in China.

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[4] See Table 25, World Development Report, IBRD, Washington, D.C., 1985.

[5] China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education op. cit.

[6] See government project preparation reports and World Bank reports: China: University Development Project 1, Report No. 3366-CHA, 1981; China: Agricultural Education Research Project, Report No. 3819-CHA, 1982; China: Polytechnic/Television University Project, Report No. 4406-CHA,1983; China: Second Agricultural Education Project, Report No. 4871-CHA, 1984; and China: Provincial Universities Project, Report No. 5673-CHA, 1986.

Issues in Management and Finance of Higher Education

1.14 In this report, issues in management and finance of higher education are examined under several categories. Chapter II reviews, first, Government's plans for long-term expansion of higher education. It examines enrollment expansion in terms of alternative goals for enrollment growth and the respective roles of different delivery systems, such as regular higher education and adult higher education. Broad estimates are made next of possible demand for, and supply of, high-level manpower in function of different prospects for, economic growth and structural change in the Chinese economy to the year 2000. Demand for technicians and engineers and for professionals in economics and finance is considered in more detail.

1.15 Chapter III investigates the structure of recurrent costs in the operation of conventional universities in China, the kernel of the higher education system. It focuses in detail on the relationship between size and type of institution and unit recurrent cost. It is recognized, for example, that the average size of university institutions in China is very small by international standards. Also many institutions are highly specialized providing training within narrowly defined disciplines. In order to formulate policies for efficient expansion of higher education, planners must ask in general: Are there major differences in cost structure among the different types of universities? Are there possible savings in per student expenditure in the expansion of existing institutions? Specific questions are: What are the principal cost components of university institutions in China? What level and share of resources is devoted to teaching, administrative and other services? What share is allocated to non-teaching services such as student housing? How do these vary by size, cost, kind of institution and by agency of Government responsible for operation (national or provincial level, SEdC or technical ministries)? The chapter concludes with observations on the cost of student boarding and related student subsidies; the prospect for some reduction in subsidies to students in the light of recent reform proposals in Beijing; the impact of the student teacher ratio on recurrent expenditure; and the possible savings in universities of larger size.

1.16 Chapter IV focuses on capital investment and physical plant management in universities in China. It examines current practices in the planning, design and construction of physical facilities; the assignment, utilization and management of space; and the maintenance and repair of equipment and facilities. This includes a comparison of space requirements with standards elsewhere; an analysis of utilization of space as practised in several universities; an estimation of maintenance budgets as a share of required maintenance; and organization structure related to physical plant operation and management. The principal questions concern: What improvements may be made in physical plant planning, design, and construction? What savings may accrue to policies for revised space standards and improvements in space utilization? What institutional changes may assist the management of university physical facilities and maintenance? What form of technical assistance and staff development would facilitate implementation of improvement in physical plant management? The chapter concludes with observations on possible reductions in space requirements and greater flexibility in their application; improvements in building design; increased utilization of classroom and laboratory space; systems for maintenance and repair; and organizational changes and opportunities for training of physical plant managers.

1.17 Chapter V discusses, in turn, the fiscal management of universities in China. It examines the strengths and weaknesses of the existing systems for revenue and expenditure classification and for cost accounting of diverse university functions -- including some functions, such as schooling for children of employees, hospitals for employees and students, printing facilities and so on, that many universities currently supply themselves but that, over the longer run, may be purchased from the outside at lower cost. It considers internal and external audit requirements and identifies the need for a standardized manual of accounts and reports for both accounting and audit purposes. The chapter examines university organization for management and for delegation of authority. It identifies revised and more formal organizational structures that would create levels of responsibility below the office of the president and would be compatible with a budgetary and accounts system that would reflect functional costs of diverse university programs and activities. It concludes with an analysis of training and technical support requirements for management personnel that may be provided by SEdC, possibly working through a proposed Higher Education Management Institute.

1.18 Chapter VI assesses the financial feasibility of the overall plans for the development of higher education to the year 2000. By incorporating a number of measures identified in Chapters III, IV, and V, the chapter examines the financial prospects for enrollment growth under different packages of reforms with repect to internal efficiency and cost-sharing in higher education. It concludes that a central scenario of medium target enrollment (to an enrollment rate of 12.5% by 2000) is only feasible with the adoption of policy changes in internal efficiency and cost-sharing.

II. EXPANSION OF HIGHER EDUCATION

Introduction

2.01 The Government of China bases its higher education development strategy to the year 2000 on two principal considerations: the ambition to increase aggregate enrollments in higher education to levels more commensurate with those of the middle-income countries, and the understanding that the technical competence of the labor force must be raised if China is to achieve the economic status of a middle-income country and, ultimately, emerge as a modern industrial state. This chapter examines these two points of view in turn. First, it reviews plans for enrollment expansion in terms of alternative goals for enrollment growth and different systems for delivery of higher education in China. Next, broad estimates are made of possible demand for and supply of high-level manpower in function of alternative scenarios of economic growth, using the World Bank multisectoral model of the Chinese economy. Finally, the chapter focuses in detail on two key occupational groups: technicians and engineers, and personnel in economics and finance.

Enrollment Expansion

2.02 A chief goal of education policy in China is to achieve a significant expansion of higher education by the end of the century. The Government is keenly aware of the substantial waste inherent in providing less than 5% of the nation's youth with opportunity for education beyond secondary school. In this regard, the Government of China places great importance on international comparisons, especially with the more advanced developing nations. In 1985 China's higher education enrollment ratio surpassed the LDC median and reached 4.8%. For the upper quartile of developing nations, a level which China aspires to reach, the ratio is now 11.0%. Projections to the year 2000, based on World Bank comparative education indicators, suggest that the upper quartile of developing nations will, by then, reach 15% or higher.7/ Figure 2.1 illustrates how the higher education enrollment ratio in China may compare with other countries between 1975 and 2000. With 1983 as base year, the Government of China has examined three different enrollment plans based on different target enrollment ratios: low, an enrollment ratio of 10% by 2000 (or an average annual rate of increase of 10.4%); medium, an enrollment ratio of 12.5% by 2000 (an average annual rate of increase of 11.8%); and high, an

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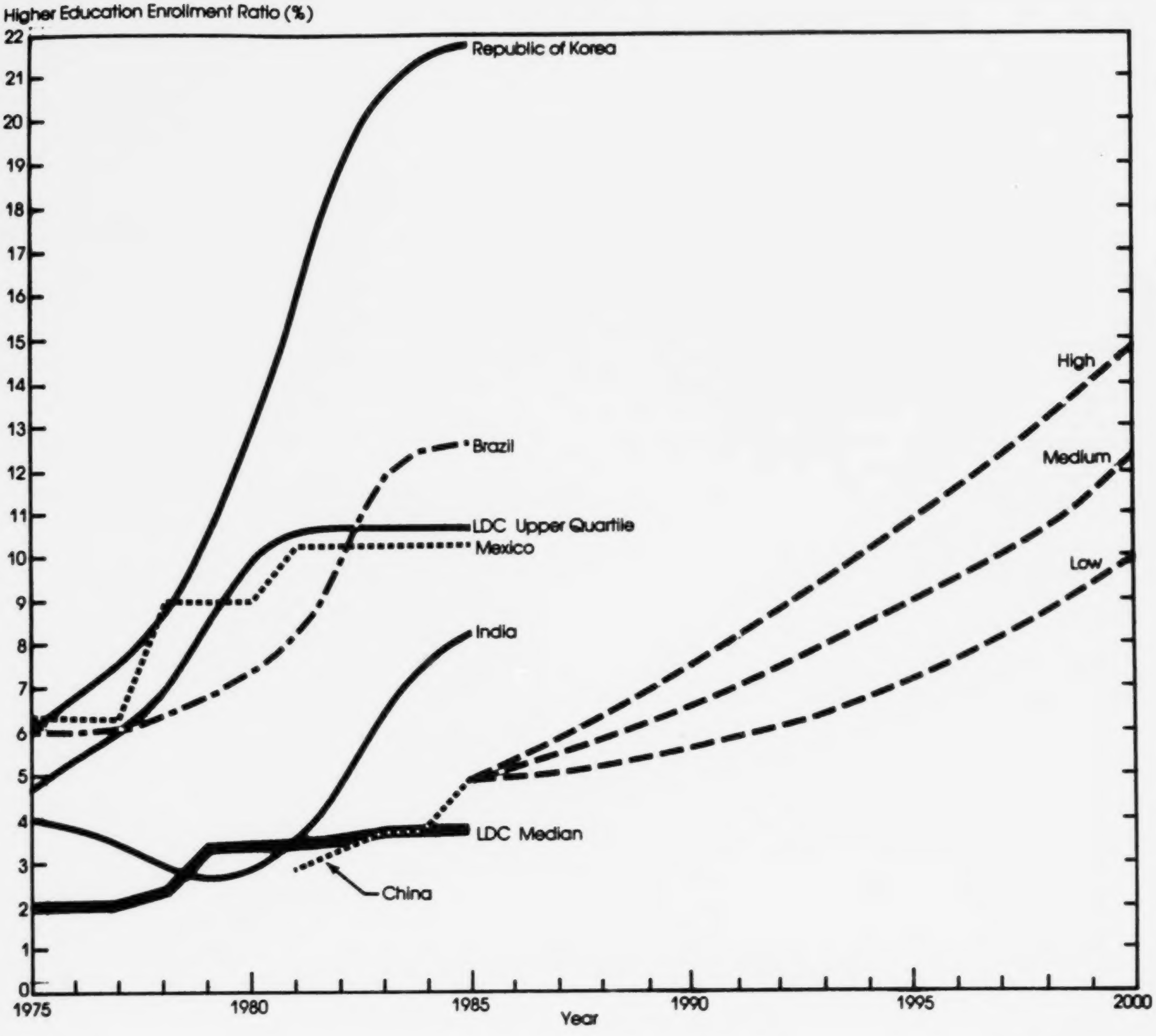
7/ While useful for indicating the direction and pace of change, international comparisons of higher education enrollments must be viewed cautiously. Taken alone, they provide no explanation of differing historical conditions that have fostered or impeded formal higher education; and they do not generally capture significant nonformal approaches to higher education -- such as spare-time worker's education, or correspondence and evening programs of regular universities -- that also serve to raise the educational qualifications of the work force.

Figure 2.1: Higher Education Enrollment in China and Other Selected Nations



World Bank—300524

Source: World Bank Comparative Education Indicators enrollment ratio of 15% by 2000 (an average annual rate of increase of 12.9%).[8]

2.03 Another perspective on the need for rapid expansion of higher education enrollment derives from the skewed education pyramid (Table 2.1). Largely because of the Cultural Revolution, which stopped or hampered higher, upper secondary and technical education for about ten years, the preparation of persons with advanced educational qualifications is relatively low (less than 1%) -- smaller in the 25-34 age group than among those over 35 -- in relation to the relatively high proportion possessing primary education (over 65%). Indeed, China's many years of isolation and corresponding disregard of higher education have contributed to the smallness of the stock of manpower equipped to apply or to teach the skills essential for modernization.

Table 2.1: EDUCATION PROFILE BY AGE, 1982
(%)

	Primary		Lower secondary		Upper secondary		Post-secondary	
Age group	Male	Female	Male	Female	Male	Female	Male	Female
Total 15 years and over	79.1	51.1	42.9	26.0	13.3	8.3	1.0	0.3
15-24	95.1	82.2	71.0	53.6	23.5	17.8	0.1	0.1
25-34	88.8	61.9	48.0	26.4	13.4	7.6	0.8	0.4
35+	63.2	24.9	21.5	7.5	6.4	2.4	1.6	0.5

Source: See Table 8.1, China: Long-Term Issues and Options. op. cit.

Alternative Delivery Systems for Higher Education

2.04 In order to reach the (medium) enrollment target of 12.5% rate of enrollment in 2000 (Figure 2.1), the entire system of higher education would need to grow by about a factor of five. A strategy in pursuit of this goal would necessarily follow three tracks: (a) sharp increase in enrollment in existing institutions; (b) establishment of new institutions; and (c) expansion of nonconventional approaches to higher education such as polytechnics, television universities, workers universities, and correspondence, special and evening programs. Table 2.2 indicates for 1983 enrollment and number of institutions by type under regular higher education or adult higher educa-

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[8] The distribution of population by age group varies, of course, across these five countries. In the target year of 2000, in China and the Republic of Korea, for example, the percentage of the total population in the 19-22 age group will be 7-8%, while in Mexico, Brazil and India, the figure will be 9-11%.

Table 2.2: ENROLLMENT IN HIGHER EDUCATION BY TYPE OF INSTITUTION

	Number of institutions 1983	Enrollment 1983	Target levels for 2000		
			Low	Medium	High
		------------- ('000)	-------------	-------------	-------------
Age cohort (19-22)			72,000	72,000	72,000
Enrollment ratio (%) /a		4.0/b	10.0	12.5	15.0
Enrollment target			7,200	9,000	10,800
Regular Higher Education					
Conventional universities	805	1,187	3,600	4,000	4,500
Polytechnics	55	20	1,600	2,000	3,100
Subtotal	860	1,207	5,200	6,000	7,600
Adult Higher Education					
Television universities /c	29	500	2,000	3,000	3,200
Workers colleges /d	840	170	300	350	400
Correspondence, special and evening programs /e	(380)	298	1,000	1,200	1,500
Other /f	322	160	400	450	500
Subtotal /g	1,191	1,128	3,700	5,000	5,600
Total	2,431	2,335	8,900	11,000	13,200

/a Enrollment ratio for the corresponding age group is measured by adding TV universities to regular higher education.
/b Enrollment ratio for 1985 is estimated at 4.8%.
/c Of this number, about 50% were enrolled in full-time study in 1983.
/d Of this number, about 20% were enrolled in full-time study in 1983.
/e Of this number, 82% were enrolled in four-year or two-year college programs in 1983. These programs are conducted either directly by or with the assistance of conventional universities.
/f This category includes universities for peasants, independent correspondence colleges, institutes for management training for cadres, and institutes for teacher in-service training. Teacher training accounts for about 80% of the total.
/g SEdC estimates that 82% of the adult higher education total are taking regular four-year or two-year college courses.

Note: Although television universities are formally classified by the Government as within the category of adult education, the majority of students are recent secondary graduates. Therefore, the enrollment in the television universities is included with that of regular higher education in the enrollment target.

Sources: Data for 1983 and possible total enrollment targets for 2000 were provided by SEdC. Enrollment targets for 2000 by category of institution were estimated by the mission based on enrollment trends and SEdC projections to 1990.

tion. It also contains projections of possible enrollment shares in the year 2000 for students in each of these systems. Prospects for their development are discussed in turn in the next section.

2.05 Conventional Universities. Enrollment in conventional universities in China (offering full-time studies mainly for residential students) will continue to grow rapidly. SEdC projects growth in enrollment at 9.8% p.a. between 1983 and 1990. Table 2.3 indicates the annual enrollment targets by major category of university. Enrollment in 1983 was distributed among 805 universities, 130 more than in 1980. These institutions are under either national or provincial management. In 1983, there were 514 provincial universities, 291 others under national administration. Of the national universities, about 100 were under the management of the SEdC, about 80 under the Ministry of Agriculture, Animal Husbandry and Fisheries, the remainder under other ministries and agencies. At the national level, 96 universities were designated as key universities, 26 controlled by SEdC. These institutions enroll an average of 4,000-5,000 undergraduate students selected from the entire nation. Although constrained by dormitory capacity, undergraduate enrollment in these institutions has been increasing at 10-15% per annum in recent years. National universities are usually more specialized. Their lower division program of studies (first two years) is largely in standard science and social science disciplines. In the upper division (final two years), undergraduate students specialize in relatively narrow fields related to the needs of the controlling ministry.

2.06 The 514 provincial universities divide into several major categories: comprehensive (23); normal universities (for teacher education) (202); technical (57); medical (88); agriculture (45); and other specialized fields such as fine arts, physical education, commerce and foreign languages (99). These institutions enroll an average of 2,000 to 2,500 students. The programs of study in comprehensive provincial universities vary considerably across the provinces. In the larger provinces, they are nearly the equivalent of a national comprehensive university. Their curricula include most standard disciplines with undergraduate and, to some extent, graduate programs. Students are drawn exclusively from the province and are generally only slightly less able as measured by the entrance examination. They will be assigned jobs in the province upon graduation. In smaller provinces, however, a comprehensive university may have a relatively small enrollment -- 1,000 to 1,500 students -- and offer a narrow range of disciplines. Six provinces do not have a comprehensive university.

2.07 Normal universities and colleges are the largest category of provincial institutions with over one third (202) of the total (514). They are divided into two classes. Major normal universities, numbering about 70 institutions, offer a four-year bachelor's degree program and usually a few graduate programs as well. These institutions devote most of their resources to training upper secondary school teachers. Students are drawn from the province as a whole. About 85% of the graduates actually go into education (about 65% into teaching) immediately after graduation. The other category is minor normal colleges that offer two- or three-year, nondegree programs for the training of lower secondary school teachers. These institutions are structured to serve a clearly defined geographic region of the province, and average four to seven per province.

Table 2.3: PROJECTED ENROLLMENT OF CONVENTIONAL UNIVERSITIES, 1983-90
('000)

	1983	1984	1985	1986	1987	1988	1989	1990	Average annual growth rate (%)
Total Enrollment	1,187	1,347	1,517	1,682	1,844	2,021	2,181	2,321	9.8
Of which:									
Normal	313	359	411	452	500	547	586	616	10.2
Comprehensive	80	86	93	101	109	118	127	137	7.9
Technical	419	462	521	572	618	658	686	713	7.9
Medical	140	154	169	190	212	239	258	278	10.3
Agricultural	68	75	84	93	103	115	127	141	10.5

Source: State Education Commission.

2.08 Provincial technical, medical and agricultural universities provide programs in selected fields of science, engineering, medicine and agriculture. These institutions fill an important need within each of the provinces, since programs of study are articulated with the needs of the provincial economies. For example, the nationally controlled technical, medical and agricultural colleges are unevenly distributed among provinces, and the national system of graduate assignment tends to satisfy first the requests of national or central agencies. As a result, provinces experience large demands for manpower in these sectors that can be satisfied only by graduates from the provincial universities. Moreover, in public health and agriculture, in particular, conditions vary among provinces, and specialized training is needed.

2.09 In developing the network of conventional universities, planners will be faced with choices between establishing new institutions and expanding existing ones. This form of higher education is, quite clearly, the backbone of the system. A strong network of conventional universities will inevitably set standards throughout higher education. But conventional universities are also the most costly component of higher education, representing as much as 78% of total public recurrent expenditure on higher education (Table 6.1). Measures to reduce costs as well as improve efficiency in the operation of conventional universities are identified in Chapters III and IV.

2.10 Polytechnic Institutions. The polytechnics are a newly established set of postsecondary institutions that offer two- or three-year courses of study. (They are otherwise referred to as short-term vocational universities or municipal universities.) Polytechnics are designed to produce middle-level technicians by offering technical education to residents of a locality and to gear output toward satisfying local manpower requirements. They also offer access to higher education for students who fail to secure a place in a conventional university after taking the national entrance examination. In 1980, the Chinese Government launched the first phase of a program to develop the polytechnic system by establishing 17 polytechnics. By 1983 the system had expanded to 55 institutions and by 1985 to over 80 institutions. Education of personnel at the sub-university level has long been neglected in China. The balance between students receiving regular university education and those receiving two- or three-year programs has not been reasonable, though the proportion enrolled in two- or three-year programs has increased from about 15% in 1979 to about 25% in 1985. In contrast to conventional university graduates who are assigned jobs upon completion of studies, graduates of the polytechnics are not guaranteed jobs. They are assisted, however, by local employment services and their rate of employment is virtually 100%.

2.11 Polytechnics promise to be innovative in several ways: (a) few residential facilities are provided, thereby overcoming a principal constraint on enrollment in conventional universities and eliminating a major cost factor; (b) new sources of funding are being tapped, including a combination of student fees and municipal and provincial funding; (c) curricula are being developed to make efficient use of physical facilities and staff; and (d) students receive training that is based on local needs. Close coordination with local enterprises, directly or indirectly through the Provincial Planning Commission, has helped to identify priority fields of study.

2.12 Adult Higher Education. Education of adults has held a prominent position in Chinese education since 1949. Representing in 1985 slightly less than one-half of total enrollment in higher education, adult higher education in China is a larger share than in any other developing country. Even in the developed countries higher education for adults does not exceed 50% of total enrollment in higher education. In China adult higher education has long been viewed by the leadership as a principal vehicle for the achievement of political and economic change.[9] For these purposes adult higher education, in particular, appeared to offer more immediate returns than those programs geared to the school-age population. There have been several compelling reasons for conducting adult education in post-revolutionary China: the need for political education in the years following liberation; the imperative to develop leadership to carry out and support social transformation in the cities and the countryside; and the evident need to raise the technical caliber of the work force in the drive for economic modernization. The relative emphasis on each of these goals has varied during this period following the course set by the political leadership. Since the late 1970s, a major concern, reflected in planning for adult education, is the relatively low educational profile of the work force. This perception continues to shape goals and strategy for adult higher education.

2.13 The existing guidelines for the development of adult education are found in a 1981 decision of a joint committee of the Party and the State Council.[10] Although quantitative targets are not spelled out, the document emphasizes that: (a) some of those with upper secondary or specialized secondary education should reach the level of a university graduate by 1985; (b) all university graduates and management personnel should acquire knowledge of modern science, technology and management; (c) the proportion of engineers and technicians to employees should be significantly increased; and (d) all leading cadres should attend short courses to study management and acquire specialized technical knowledge. The more recent Decision on Education Reform of the Central Party Committee, announced May 29, 1985, has underscored this commitment to adult education. The newly created State Education Commission (SEdC) has been assigned responsibility for drawing up a further "special decision" for improving and strengthening adult education.

2.14 As shown in Table 2.2, adult higher education takes a variety of forms. These include: the rapidly expanding system of education via television (and radio) broadcasting; universities for workers and for peasants; institutions for management training of cadres; correspondence programs operated independently of formal academic institutions; education institutes for in-service training of teachers and management personnel in the education sector; and, finally, special courses, as well as evening and correspondence programs offered by polytechnic institutes and by conventional universities (See Annex A for a description and review of the strengths and weaknesses of each type of adult higher education.) There are primarily three modes of adult higher education used in China: full-time in which employees are released with full pay and benefits for a period of time ranging from six months to three years; part-time which is a form of in-service training typically amounting to short-term courses of varying lengths; and spare-time which is about four to six hours each week in addition to regular working hours.

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[9] For a summary of adult education during the post-revolutionary period, see Colletta, N.J., Worker-Peasant Education in the People's Republic of China, World Bank Staff Working Paper No. 527, Washington, D.C. 1982. See also Chambers, D.I., "Adult Education in Urban-Industrial China: Problems, Policies and Prospects," in R. Hayhoe, ed., Contemporary Chinese Education, M.E. Sharpe, Inc., Armonk, New York, 1984.

[10] Decision on Strengthening Work in Employee Education, Beijing, 1981.

2.15 Management of programs of adult higher education is exercised by a great number of governmental and nongovernmental agencies. Most of these have considerable autonomy over the education programs conducted under their auspices. The principle of "adapting policy to local conditions" implies that most decisions concerning curriculum, academic standards, qualifications of teachers, and provision of equipment and facilities are resolved at municipal, prefectural or at provincial levels. Overall responsibility for adult education is essentially vested in the SEdC, with specific functions assigned to the Third Bureau of Higher Education and the Bureau of Worker-Peasant Education. The SEdC directly manages only the operations of the Central Radio and Television University and the extramural programs offered by key universities of the central government. At the provincial level, SEdC policies and strategy for adult higher education are executed by provincial departments of education or higher education. At the national level, each technical ministry has an education department which is responsible for teaching plans and implementation of adult education in specialized educational institutions of that ministry as well as administration related to programs for employee training provided by individual enterprises of the sector.

2.16 As a result of this diversity of types of adult higher education and the decentralized form of administration, detailed information on the scale of this activity is difficult to assemble. A statement by SEdC issued in 1984 reports about 1,200 different institutions of higher education for adults, as summarized in Table 2.2.[11] This includes 29 TV universities; 840 universities for workers and cadres; 4 universities for peasants; 300 institutes of education for advanced studies and in-service training of teachers; 3 independent correspondence colleges; and 15 institutes for management training. In addition, about 380 conventional universities and polytechnics were operating correspondence colleges and evening courses. In 1983, enrollment at institutions of higher education for adults totaled 1,128,000 students, of whom 926,000 or 82% were engaged in regular programs for the equivalent of two-year or four-year college courses. SEdC also reported 1,207,000 regular students in colleges and universities. The share of adult higher education in total higher education is, therefore, about 48%. The distribution of adult students in higher education by type of education indicates the relative importance of

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11/ The Latest Developments in China's Education, 1981-1983, Ministry of Education, Beijing, 1984.

each type. According to enrollment statistics for 1983 in Table 2.2, about 46% of students were registered in the TVU system; about 15% in workers universities; about 25% in special, correspondence or evening programs run by regular universities; about 13% in teacher in-service training; and the remainder, about 1%, in universities for peasants, management schools for cadres or independent correspondence programs. Expansion since 1979 has been most rapid in the TVU system -- that is performing the function in China of an "open university" to meet a variety of needs and groups -- and in special, correspondence and evening programs operated by conventional universities and polytechnics. Enrollment in worker and peasant universities, that reached a maximum during the Cultural Revolution, has held steady in recent years.

2.17 In summary, rapid expansion of higher education requires the development of regular higher education, the conventional universities and polytechnics, as well as adult higher education in its many forms. Under the medium enrollment plan, designed to achieve gross enrollment of 12.5% by 2000, regular higher education, including polytechnics, is scheduled to grow about fivefold. Adult higher education, already operating on a comparatively large scale, is likely to expand approximately 4.4 times from 1983 to 2000. But the television university system, in particular, representing an innovative approach to service delivery is likely to grow six-fold over this period, faster than any other component. Despite the higher cost, this somewhat greater emphasis on regular higher education, including the rapidly expanding network of short-term polytechnics, -- as well as on the television university system -- is explained by the priority for expanding full-time programs for secondary graduates versus continuing education for adults. It also indicates recognition of the generally higher quality of education in the regular stream and the television university system that together have received major new investments since 1979. Moreover, about 25% of enrollment in adult higher education will likely enter correspondence, special and evening programs offered by conventional universities and polytechnics -- a desirable trend in that these institutions could make more intensive use of their improving facilities and resources by offering such programs for mature students. With the exception of the TV university system that will continue to grow very rapidly, other programs, such as workers colleges, and inservice management colleges, will continue to provide important services but will expand student enrollments at a slower pace.

Global Estimates of Demand and Supply of High-Level Manpower

2.18 Enrollment growth must also be tailored to economic considerations, including both the demand for high-level manpower as a function of economic development and a realistic assessment of the capacity to finance and sustain an expanded system of higher education. (Questions of finance are examined in Chapter VI.) China has embarked on an ambitious long-term plan for economic development that aims at quadrupling output to the year 2000. Concurrently, very rapid development of education has also been planned, and higher education has been targeted as the subsector within education to expand most rapidly. At issue is whether the planned development of higher education will meet the human resource demands of rapid growth and substantial structural change in the economy. A related question is whether there will be an imbalance in supply and demand of graduates in major fields.

2.19 Planning of both the level and the composition of expenditures on higher education in China is linked to manpower forecasting. However, manpower forecasting has proved problematic (though less so in projecting needs for teachers and doctors than in other areas). Manpower forecasts in countries particularly active in the field some time ago -- Canada, the United Kingdom, France, India, Nigeria and Zambia -- were especially inaccurate more than three to five years ahead. Forecasts were usually based on estimates provided by enterprises of the numbers of workers with particular skills (especially in scientific and technical areas) they would require. But only very large firms regularly forecast personnel requirements. And they can only guess at their individual relative shares of the total market, so that the forecasts of individual firms may be quite inconsistent and cannot be aggregated into a forecast for the whole economy.

2.20 Complex manpower planning methods -- which attempt to calculate labor requirements (by occupation, sector and industry) based on output and productivity forecasts, and to convert them into an educational structure through estimates of the level of formal education required for each occupation -- have been no more successful. Converting information about occupations into educational needs is difficult partly because it involves aggregating varying amounts and kinds of formal and nonformal education. But the main problem of this approach is its neglect of the possibilities for substitution: depending on prices, wages and availability, enterprises produce given amounts of output with widely varying mixes of labor and machinery, of different occupational skills, and (within occupations) of different educational qualifications.

2.21 Manpower planning in China is likely to suffer from all these problems, but the consequences of error could be much more serious, at least if skilled labor continues to be administratively allocated. In other countries, inaccurate manpower forecasts are less worrisome, because both individuals and enterprises can respond more flexibly to errors: for example, if 1,000 doctors had been trained while only 500 were needed, the 500 best doctors would find medical employment, while the others sought retraining or jobs requiring more general skills. By contrast, with administrative allocation, the forecasting error would be less conspicuous, but enterprises that really needed a doctor and an engineer would find themselves with two doctors and no engineer.

2.22 The difficulties of manpower forecasting are mitigated somewhat in China by the diversity of post-secondary education -- encompassing both the regular stream and adult higher education -- offering several routes to any given educational qualification. In particular, the polytechnic system, which offers mainly two year programs, represents a flexible response on the part of the educational authorities to local demand for qualified manpower. Courses of study for adults allow for further specialization of employees in line with current or future job requirements.

2.23 Less positively, the considerable diversity of higher education in China is offset to some extent by excessively specialized fields of study, numbering in total several hundred. This narrow definition of field of study has several disadvantages in a period of rapid economic growth and related diversification in the labor force. It does not prepare graduates well for introduction of new technologies or to changing job requirement experienced over a working career. Nor does such a high degree of specialization in training facilitate adjustment within the educational institutions to the new knowledge and skill requirements for graduates. SEdC has recognized these disadvantages of narrowly guaged fields of study and initiated the design of new, broader curricula in major fields of study. This development also eases somewhat the task of manpower forecasting. It is less difficult, for example, to forecast the demand for chemists than for organic chemists, inorganic chemists and industrial chemists. The difficulties of manpower forecasting thus strengthen the case for broad curricula, with highly specialized skills acquired after, not during, formal study.

2.24 Despite the limitations inherent in any forecast, demand and supply projections that are revised perodically may provide insight into movements toward or away from balance. As a tool for planning, the direction of these movements is perhaps more important than the degree of imbalance shown by any single estimation. The World Bank has developed an economic model of the Chinese economy to provide a consistent numerical framework for the discussion of prospects for economic growth and structural change.[12/] This model is a simplified representation of China's whole economy broken down into 20 sectors. The use of this model for broad-based analysis of the relation between projections of enrollment growth in higher education and possible changes in the size and composition of the labor force is considered instructive. The following section traces some of the applications of this model in terms of prospects for demand and supply of high-level manpower. It examines in greater detail two major occupational groupings, technician and engineering training and preparation of postsecondary personnel in economics and finance, that have received World Bank assistance.

2.25 Projected Demand for University Graduates in 2000.[13/] The basis of estimations of demand for university graduates in the year 2000 are three scenarios of employment -- QUADRUPLE, MODERATE, BALANCE -- in the year 2000 projected by the multisectoral model. The QUADRUPLE projection attains the Government's target of quadrupling the gross value of industrial and agricultural output (GVIAO) between 1980 and 2000. The MODERATE projection maintains most of the assumptions made in QUADRUPLE, including the same aggregate savings rate, but takes a less optimistic view of the future efficiency of China's economy and consequently projects lower growth. The BALANCE projection represents an alternative way of attaining the same growth rate of per capita national income as in QUADRUPLE by giving greater weight to the services sector, specifically to commerce and miscellaneous business and personal services. The BALANCE scenario would also shift the future structure of China's economy away from the Soviet pattern and toward the pattern of Japan and the

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[12/] This model is described in full in China: Long-Term Issues and Options, Annex E, op. cit.

[13/] For these projections, university graduates include all those with education completed beyond the secondary level.

market-oriented developed countries. The estimates of demand used here are based on the application of 1982 ratios of graduates to total workers in the 20 major sectors in the model, and adjustments of these ratios to levels estimated for 1965 before the Cultural Revolution.[14] The actual 1982 ratios of graduates to total workers by sector in China are well below expected levels by comparison with other low income countries. The principal cause is the sharp decline in higher education graduation in the 15 years from 1965 to 1980. As revealed by the 1982 census, participation in higher education for those entering the labor force in 1976-1981, was approximately one half that of the group entering between 1960 and 1965 (See Table 2.1). All three scenarios project a sizable shift of production and, hence, employment from the agricultural sector to the nonagricultural sector in the course of economic growth. The BALANCE scenario differs substantially from the other two in that it projects a much more substantial shift in production and employment from agriculture to services than to industry. This shift in employment by sector under each scenario results in a different average rate of graduates per total workers in each case for the year 2000.

2.26 The model projects an overall demand of 14.4 million to 22.3 million university graduates in the year 2000 (See Table 2.4). In the MODERATE scenario of structural change, the demand for university graduates rises to 2.9% of the labor force. The proportions in the QUADRUPLE and BALANCE scenarios will be somewhat higher at 3.1% and 3.5%, respectively. These projected proportions would still be below those in other Asian economies in the 1960-80 period. For example, the proportion of university graduates in the labor force in the Philippines was 3.5% in 1970 and 7.2% in 1980. In South Korea, it was 2.4% in 1960 and 5.2% in 1970. If the proportion of graduates in the labor force in China were to increase to levels comparable to those of the Philippines in 1970 or 1980, or that of South Korea in 1970, the demand for university graduates would range from 22.1 million to 31.6 million to 39.1 million.

2.27 Projected Supply of Graduates by 2000. The output of graduates in China from 1983-2000 can vary substantially depending on the ability of China to use its resources to sustain the targeted rate of growth to the year 2000. According to the different scenarios of enrollment growth of Table 2.2 -- low (10% enrollment ratio by 2000), medium (12.4% enrollment ratio) and high (15% enrollment ratio) -- the cumulative output of graduates would range from 15.6 million to 20.1 million between 1983 and 2000. See Table 2.5 for these estimates. Annual output in 1983 was about 335,000. By 2000, annual output would increase to 1.8 million in the low scenario of growth of enrollment or to as high as 2.6 million in the high scenario. Although the annual rates of growth in enrollment from 1983 to 2000 under each of these scenarios are ambitious -- in the low scenario, 10.4% per annum; in the medium scenario, 11.8% per annum; and in the high scenario 15% per annum -- they are

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[14] These levels are judged reasonable for the Chinese economy in the light of the historical experience of other major countries, for example, Japan and Brazil. See Zymelman, M., Occupational Structures of Industries, World Bank, Washington, D.C., 1980.

Table 2.4: PROJECTED DEMAND FOR UNIVERSITY GRADUATES IN THE YEAR 2000 (millions)

	1982	2000 scenarios		
		QUADRUPLE	MODERATE	BALANCE
Labor force	522.1	631.1		
University graduates as a % of the labor force	1.60/a	3.1	2.9	3.5
University graduates demanded	4.20	19.7	14.4	22.3

/a Adjusted to the estimated share for 1965 prior to the Cultural Revolution.

Table 2.5: PROJECTED SUPPLY OF UNIVERSITY GRADUATES IN THE YEAR 2000 (Million)

	Projected growth in enrollment		
	Low	Medium	High
Graduates in labor force, 1982		4.2	
Cumulative output (1983-2000)	15.6	17.7	20.1
Cumulative attrition of graduates /a (1983-2000)		1.8	
Supply of graduates in the year 2000	18.0	20.1	22.5
Annual output in the year 2000	1.8	2.2	2.6
Supply as share of labor force in the year 2000 (%)	2.8	3.1	3.5

/a Assumes a retirement age of 60 and, therefore, graduates in the 55-59, 50-54 and half of the 45-49 age groups in 1982 will have left the labor force by the year 2000.

not unprecedented. In China during the First Five-Year Plan the growth rate in higher education averaged 16.7% per annum. The growth rate of higher education in South Korea was 10% per annum between 1950 and 1960, 7% per annum in the 1960s, and about 20% per annum, 1979-1984. Growth rates in other newly industrialized countries in Asia in the 1960-80 period were much lower -- about 8% annually.

2.28 Adequacy of Supply of University Graduates in 2000. According to these estimates of aggregate demand and supply, the medium growth scenario to an enrollment ratio of 12.5% would provide more than sufficient graduates in the year 2000 under both the QUADRUPLE and MODERATE projections. The medium growth scenario would probably not satisfy demand for graduates in the year 2000 under the BALANCE projection, because of the rapid adjustment in this case to a larger services sector that is more graduate-intensive in its use of labor. The high growth plan, for an enrollment ratio of 15% by 2000, would be adequate in the face of demand projections from any one of the three applications of the multi-sector model. The low projection of growth in enrollment, to an enrollment rate of 10% by 2000, would generate adequate supply only in the case of the MODERATE, or low-growth projection of the multi-sectoral model. Given the wide confidence intervals that must apply to projections as global and imprecise as these, one should avoid too rigid an interpretation of these results. It should suffice merely to affirm that the medium enrollment plan is reasonable in view of historic enrollment growth rates for higher education in China and of possible demand for high-level manpower. The ratio of graduates to workers in the labor force would approach, but not surpass, levels achieved in other countries in the East Asia region such as South Korea and the Philippines by 1960 or 1970. And aggregate supply of high-level manpower would approximate broad estimates of demand.

2.29 Quite obviously, as important as the overall scale of higher education is the breakdown of enrollments by major fields of study. As noted earlier (paras. 2.19-2.23) attempts to address the question of the composition of enrollment by means of manpower forecasting have generally proved unreliable. However, forecasts with a short planning horizon, two or three years, and that are repeated annually or bi-annually are less subject to wide error. Such an approach is undoubtedly desirable in situations where enrollment planning by field of study is required. At present in China there is wide evidence of current or impending shortages in certain major fields of study. Information accumulated from enterprise surveys, interviews with municipal, provincial and national authorities and information provided by SEdC and the Ministry of Labor and Personnel confirm that annual requests for qualified high-level manpower can be satisfied only in part. Shortages are particularly acute in scientific, technical and engineering fields, in management, including personnel trained in economics, finance, law and general administration, in health fields and in education. The following sections review in a broad framework prospects for requirements of personnel in engineering fields and in economics and finance as defined by the Chinese system of occupational classification.

2.30 Aggregate Demand and Supply of Graduate Technicians and Engineers 1982-2000. In 1982, technicians and engineers comprised just over half a percent (0.56%) of the total labor force in China and 42% of them were university graduates. In comparison to other middle-income countries, where technicians and engineers may represent 2% to 3% of the labor force, the proportion of technicians and engineers in the labor force in China was low. Not surprisingly, there are widespread reports of shortages in manufacturing, energy and transportation sectors. The proportion of technicians and engineers in the labor force varies substantially by sector. The most striking is the very high proportion in some of the service subsectors such as public administration and research and technical services. Technicians and engineers comprised 3.5% of the labor force in the electrical industry, 3% in construction, but 4.8% of the labor force in public administration and 13.5% in research and technical services. In aggregate, over 23% of all technicians and engineers in the country were employed in public administration or research and technical services industries, while 37% were employed in manufacturing. Not only does the share of technicians and engineers vary by sector, but there is also an imbalance in deployment of technicians per engineer. In China the overall ratio is one-to-one. The standard in industrialized economies is more like four technicians per engineer.

2.31 Different scenarios of demand for graduate technicians and engineers in the year 2000 can be formulated based on the three runs of the multisectoral model. Across China only 42% of those currently in positions as technicians or engineers actually hold graduate qualifications. With no upgrading of the labor force, the three scenarios of growth will generate a demand of between 5.5 million and 9.6 million technicians and engineers by the year 2000 (See Table 2.6). If the proportion of technicians and engineers who are graduates remains unchanged, the demand for graduate technicians and engineers will range from 2.3 million to 4.0 million. The larger figure is obtained in the case of the BALANCE scenario because of a substantial shift in the share of employment to the service subsector which employs higher proportions of technicians and engineers.

2.32 The Chinese Government has targeted an 8% annual growth rate in enrollment in technician and engineering programs until 1990. While this is a substantial rate of growth, it is below growth rates in engineering enrollment in South Korea which were 8% to 13% in the late 1960s and early 1970s. If the target growth rate for increased enrollment for technicians and engineers for 1983-90 is attained and sustained through the 1990s, the supply of graduate technicians and engineers in the year 2000 would be about 6.0 million, sufficient, by this calculation, to meet projected demand. An interesting question is what rate of growth in enrollment in technician and engineering programs would be necessary to accommodate a higher proportion of graduate technicians and engineers in technical and engineering occupations. At the projected 8% growth rate of enrollment in technician and engineering programs, supply in the year 2000 would be able to meet demand created under all scenarios of growth and allow for graduates to comprise about 55% of all technicians and engineers. If enrollment of technicians and engineers were scheduled to increase on a par with the overall medium plan for university enrollment, 11.8% per annum to 2,000, the supply of graduate technicians and engineers could increase to about 70% of all technicians and engineers. Further, since two- and three-year programs of polytechnics are scheduled to grow much more rapidly than conventional universities, the ratio of graduate technicians to engineers in the labor force would adjust in favor of a greater

Table 2.6: PROJECTIONS OF DEMAND FOR TECHNICIANS AND ENGINEERS IN THE YEAR 2000
(Million)

		2000		
	1982	QUADRUPLE	MODERATE	BALANCE
Number of technicians and engineers	2.9	5.6	5.5	9.6
% of labor force	0.56	0.87	0.87	1.52
Number of Graduates				
42% of total	1.2	2.3	2.3	4.0
55% of total	-	3.1	3.0	5.3
70% of total	-	3.9	3.8	6.7

share of graduate technicians. This would represent a more reasonable structure.

2.33 Aggregate Demand and Supply of Professional and Technical Personnel in Economics and Finance, 1982-2000. In the 1982 census, professional and technical personnel in economics and finance constituted a sizable group, 29%, within the professional and technical personnel category, and 1.5% of the total labor force. Occupations included are management, administrative and support personnel in the public service (including education), in state and collective enterprises and in personal services requiring training in economics, finance, accounting and related fields. What is most remarkable, the level of education of these personnel was very low in comparison to other professional and technical personnel. Only 1.6% of professional and technical personnel in economics and finance were graduates compared to 12.5% of all such personnel. The highest proportions of economics and finance professionals to the labor force were found in the service subsector: finance and insurance (34.3%), public administration (12.1%) and commerce (7.7%).

2.34 Demand for professional and technical personnel in economics and finance in the year 2000 may also be projected using the multisectoral model. With this occupational group demand will vary substantially, depending on the path of structural change and growth that China follows (See Table 2.7). Demand in the BALANCE scenario of growth would be almost 27 million -- substantially higher than demand in the QUADRUPLE or MODERATE scenarios (14.7 and 14.5 million, respectively). This is because of the very high proportion of economics and finance personnel in the service sectors, and in the BALANCE scenario employment in these sectors is projected to grow much more rapidly relative to other sectors. If the very low proportion of graduates of 1982 were maintained, however, demand for graduate economics and finance personnel would be small -- between 230,000 and 430,000 -- in all scenarios. If the proportion of graduates among professional and technical personnel in economics and finance is increased to only 5%, total demand for graduates rises quite dramatically, between 740,000 and 1.3 million.

2.35 Recognizing the current small supply of graduates in economics and finance and the future increase in demand, the Chinese Government has targeted a 14% annual rate of growth in university enrollment in economics and finance through at least 1990. This is a very high rate of growth -- substantially higher than the rate of growth in total university enrollment under the high growth plan, 12.9% per annum. Under the assumption that a 14% rate of growth can be sustained through the year 2000, the supply of graduates in economics and finance in the labor force would be approximately 1.0 million. This would be sufficient to meet projected demand in all three scenarios with an increase in the proportion of graduates to 3.5% under the BALANCE scenario and to 6.5% under the QUADRUPLE and MODERATE scenarios. Even at this high rate of growth, however, the proportion of graduates among economics and finance professional and technical personnel in the labor force would remain very low, and many skills would have to be learned on the job or through informal, and nondegree education. These estimations confirm the Government's view that higher education in this occupational category, closely linked to modernization of management and financial operations in China, should expand at the highest possible rate.

Table 2.7: PROJECTIONS OF DEMAND FOR PROFESSIONAL AND TECHNICAL PERSONNEL IN ECONOMICS AND FINANCE IN THE YEAR 2000 ('000)

	1982	2000		
		QUADRUPLE	MODERATE	BALANCE
Number of professional and technical personnel in economics and finance	7,700	14,700	14,500	27,000
% of labor force	1.5	2.3	2.3	4.3
Number of Graduate Professional and Technical Personnel in Economics and Finance				
1.6% of total	-	240	240	430
3.5% of total	-	520	500	950
5.0% of total	-	740	730	1,350
6.5% of total	-	960	940	1,750

2.36 National Demand and Supply of University Graduates in the Year 2000. These global estimates of demand and supply for high-level manpower allow for several broad conclusions. They are summarized as follows: First, China is embarking on an ambitious plan of expansion of university enrollment for the 1980s and 1990s. No overall shortage of university graduates in the year 2000 is projected as long as China is content with a skill level of its work force in the year 2000, as measured by educational attainment, that will be comparable to that of other Asian economies such as South Korea and the Philippines in 1960 and 1970. Second, even at the low level of disaggregation of fields of study used in this analysis, there are substantial differences among specializations in the adequacy of future output to meet demand in the year 2000. The projected supply of graduate technicians and engineers should satisfy projected demand, which includes an upgrading of the educational level of engineering and technical personnel. There will be more of a problem of supply of professional and technical personnel in economics and finance, where even very optimistic scenarios of enrollment growth will only meet demand in a more service sector-oriented economy by allowing minimal upgrading of the general level of education of these workers. And finally, adult higher education will continue to be an important substitute for formal university education in many specializations in the year 2000.

2.37 In sum, the growth scenarios for higher education reviewed in this chapter are ambitious, but do not differ substantially from patterns of development of higher education in other rapidly growing economies in the 1960s and 1970s. The size of the university-age population in China will decline in the 1990s and level off in the first decade of the next century. But there will continue to be a large pool of graduates desiring a university education because of the low enrollment ratios recorded in the 1980s and because the planned secondary level enrollment ratio will itself reach about 70% by the end of this century. The output of university graduates will be constrained only by the amount of resources that can be devoted to higher education, and the efficiency with which these resources can be managed.

III. ANALYSIS OF RECURRENT COSTS OF UNIVERSITY INSTITUTIONS

Introduction

3.01 This chapter investigates the structure of annual recurrent costs in the operation of conventional universities in China and examines in detail the relationship between size of institution and unit recurrent cost. The structure of recurrent costs is of interest for several reasons. First, by comparing the pattern of costs across university institutions it may be possible to detect areas where management could make savings within institutions. Second, if a certain size of university tends to minimize recurrent cost there is scope for what may be in aggregate considerable savings in education expenditure. And third, decisions on whether to establish new institutions or to expand existing ones may have major cost implications. Altogether such information is of direct operational value to those seeking to achieve economic efficiency in university management with acceptable standards of quality.

3.02 The analysis focusses on three areas of interest: the structure of recurrent expenditure by kind of university institution and category of expenditure; the effect of size on unit recurrent cost; and, finally, simulations of unit recurrent cost taking into consideration the kind of institution, and changes in enrollment and in the student teacher ratio. The analysis of recurrent costs in this chapter concentrates on conventional universities. These are the mainline institutions among the array of higher education institutions in China. They are also the most expensive. The mission estimates that unit recurrent costs for conventional universities are about double the costs of polytechnics or of universities for workers and between seven to ten times greater than per student cost in correspondence or special programs or within the TVU system. Moreover conventional universities are representative of the standards that the other branches of higher education view as ideal. Information in this chapter on expenditure in conventional universities was collected for 136 universities from World Bank appraisal reports, and from a questionnaire prepared by Bank staff and submitted to 77 universities. These data cover the academic year 1981-82 or, in a few cases, 1982-83. All cost estimates have been adjusted to 1981 prices. Annex B contains the definitions of cost categories used in the analysis. Annex C contains the cost questionnaire. Annex D presents the detailed procedures and findings on average recurrent costs.

Structure of Recurrent Expenditure

3.03 The questionnaire which was completed in full by 67 university institutions (10 of the 77 institutions that completed the questionnaire have missing data) provides a detailed breakdown of recurrent expenditure by category of expenditures.[14] Average recurrent cost per student is estimated, in this case, on the basis of total number of students, including full-time undergraduates as well as graduate and special students. This approach is the most reliable for comparisons across institutions since it was not possible, given the current accounting system in Chinese universities, to distinguish among expenditures by type of student. The effect of this approach is to lower the estimate of average per student costs below the expected average for full-time undergraduate students. The mission estimates that average recurrent cost for full-time undergraduate students in 1981-1982 was about Y 1,600. Tables 3.1 and 3.2 show the distribution of recurrent expenditure by kind of institution and by affiliation for the institutions in the questionnaire data file. These tables reveal some interesting patterns. The average recurrent cost per student reported in this file is Y 1,320 in 1981 prices. Of this amount 37% is expended in personnel costs, with cost of administrators 9%, teachers 20%, other staff 8%. The share of total recurrent expenditure accounted for by expenditure directly related to instruction, but excluding personnel costs, is 27%. Noninstructional-related expenditure averages 23%; in this total 7% is expended on student boarding, 3% on transportation-related expenditure and 13% on other materials and supplies and on maintenance of grounds, buildings and equipment. Assistance to students, including various grants, allowances and subsidies, account for 13% of total recurrent expenditure.

3.04 The tables indicate that this pattern differs to some extent by kind of institution and by affiliation. Some of these differences are worth noting, even though the number of institutions of each kind is small. First, as would be expected on the basis of comparisons with other countries, agriculture, science and technology, and medical universities are above average in cost per student. Economics, comprehensive and normal universities are below average in cost. Second, as noted, personnel-related expenditure accounts for slightly more than one-third of recurrent expenditure for institutions in this file. Policies that would affect the deployment of teaching staff (54% of total personnel costs), such as an increase in the student teacher ratio,

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[14] The basic variables reported in Annex B Tables B.1 and B.2, have been combined into aggregate form. Total personnel-related expenditure (PRE) is the sum of salaries, subsidies and benefits for all employees. Expenditure on salaries, subsidies and benefits for administrators is ADE; the corresponding figure for teachers is TEE; and for other staff is OTE. Therefore PRE = ADE + TEE + OTE. Instructional-related expenditure, IRE, is composed of expenditure on consumable materials in classrooms, laboratories, workshops (CONM), books and other reading materials (BKS), and other consumables (OTS). Noninstructional-related expenditures (NIRE), is composed of consumable materials and supplies for student boarding (CONMS), transportation-related expenditure (TRSP), expenditure on other materials and supplies and maintenance of grounds, buildings, and equipment (MB). Expenditure on public utilities (UTL) was left out of this analysis. (See Annex D, para. 7). Finally, direct subsidies to students is identified as PTS. Accordingly, total recurrent expenditure or TRE = PRE + IRE + NIRE + PTS.

DATA SET = ALL QUESTIONNAIRES
Number of observations = 67

Table 3.1: CHINA: STRUCTURE OF RECURRENT COSTS BY KIND OF INSTITUTION

Kind of institution	Unit recurrent cost (Y)/b	Distribution (%)									
			Of which					Of which			
		PRE	ADE	TEE	OTE	IRE	NIRE	CONMS	TRSP	MB	PTS
Average	1,320	37	9	20	8	27	23	7	3	13	13
Agriculture, forestry, fishery, etc. (3) /a	2,403	32	7	18	6	31	29	9	3	17	8
Science and technology (21)	1,560	39	8	22	9	25	26	9	2	15	10
Economics, finance, law, political science (3)	860	35	11	18	6	22	31	5	21	5	12
Comprehensive (16)	1,080	38	8	21	9	26	22	7	2	13	14
Normal (21)	1,150	35	10	19	6	29	19	8	3	8	17
Medical (3)	1,540	41	8	28	5	26	26	8	10	8	7

/a Number in parentheses is the number of institutions in the corresponding category.

/b Unit recurrent cost is measured as total recurrent expenditure divided by the total number of students or AVC3 as defined in Annex B.

CODA:
PRE - total expenditure on personnel
ADE - total expenditure on administrators
TEE - total expenditure on teachers
OTE - total expenditure on other staff
IRE - total instructional-related expenditure, not related to personnel
NIRE - total noninstructional-related expenditure
COMNS - total consumable materials and supplies for student boarding
TRSP - total transportation - related expenditure
MB - total expenditure on other materials and supplies and on maintenance of grounds, buildings and equipment
PTS - total direct subsidies to students

DATA SET = ALL QUESTIONNAIRES
Number of observations = 67

Table 3.2: CHINA: STRUCTURE OF RECURRENT COSTS BY AFFILIATION

Affiliation	Unit recurrent cost (Y)/b	Distribution (%)									
			Of which					Of which			
		PRE	ADE	TEE	OTE	IRE	NIRE	CONMS	TRSP	MB	PTS
Ministry of Education (24) /a	1,510	38	8	21	9	25	27	6	7	14	10
Provincial/municipal administration (43)	1,210	37	9	21	7	27	21	8	2	11	15

/a Number in parentheses is the number of institutions in the corresponding category.

/b Unit recurrent cost is measured as total recurrent expenditure divided by the total number of students or AVC3 as defined in Annex B.

CODA:
PRE - total expenditure on personnel
ADE - total expenditure on administrators
TEE - total expenditure on teachers
OTE - total expenditure on other staff
IRE - total instructional-related expenditures, not related to personnel
NIRE - total noninstructional- related expenditure
COMNS - total consumable materials and supplies for student boarding
TRSP - total transportation - related expenditure
MB - total expenditure on other materials and supplies and on maintenance of grounds, buildings and equipment
PTS - total direct subsidies to students

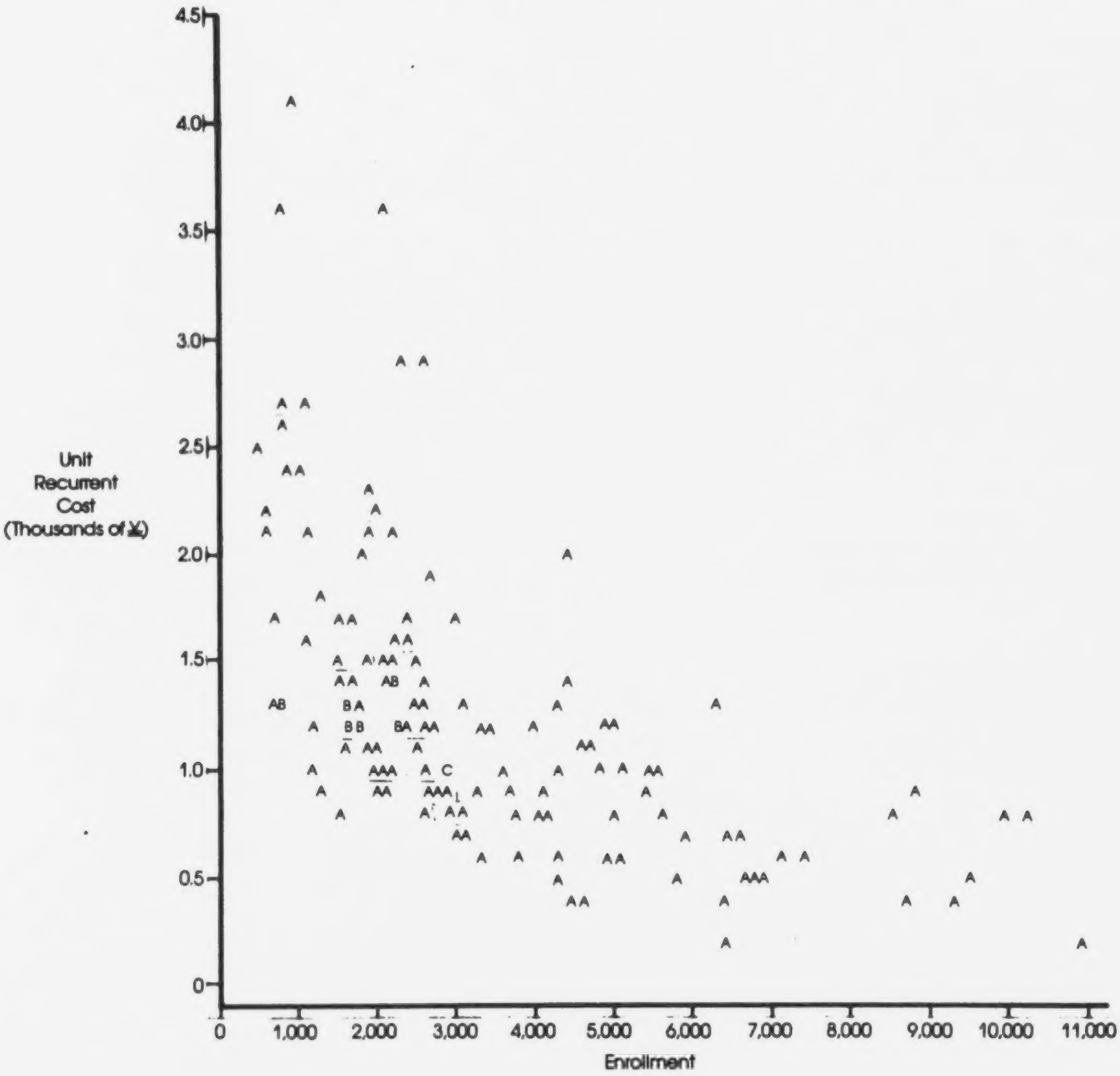
could significantly reduce unit recurrent cost. By the same token, policies to improve remuneration of university (and education sector) personnel, as announced by the Government in mid-1985, would increase operating expenses but may be balanced by policy to increase the student teacher ratio. Third, a significant component of recurrent cost is the cost of operating student residences as well as assistance to students, such as fellowships, subsidies, and food allowances, to underwrite some share of out-of-pocket expenses of attending university. These two items account for about 20% of recurrent expenditure. For those institutions in the data file operated by provincial governments (normal universities and comprehensive provincial universities), these two items add to 23% of total recurrent expenditure largely because students of normal universities receive a fixed stipend on the order of Y 18.50 per month. In the case of these institutions, as seen in Table 3.2, unit recurrent cost per student is only Y 1,210, below the average for the file, yet this form of subsidy to students amounts to Y 280 per student per year. It represents a standard that will be difficult, and perhaps inadvisable, to maintain over the long run in managing the expansion of higher education in China.

Existence of Scale Economies

3.05 A second area of interest is the effect of size, or student enrollment, on unit recurrent cost. The chief goal has been to detect whether unit recurrent cost changes as a function solely of the number of students. That there is an underlying relationship between unit recurrent cost and the size of enrollment is suggested by simple plots of average recurrent cost by size of institution. Figure 3.1 is a scatter diagram of the pair-wise relation between unit recurrent cost (measured in thousands of Yuan on the vertical axis) and student enrollment (on the horizontal axis) for 136 universities in China submitting data. This scatter diagram illustrates a generally declining average recurrent cost for institutions of larger size.

3.06 The likelihood that the relation between unit recurrent cost and enrollment would assume the general pattern in Figure 3.1 can be seen in the following general argument. Initially unit recurrent cost of a university may be quite high due to the fact that an institution must, even though its enrollment may be small, provide a certain minimum number of courses. The offering of even a limited curriculum implies a minimum number of staff (teachers, administrators and other personnel) and the operation of classrooms, laboratories and support facilities. Faced with the prospect of increasing student enrollment, without increasing the number of courses, staff and facilities, the institution may merely increase its student staff ratio, the number of teaching hours per staff member and use of existing facilities. Unit recurrent cost would therefore decline as enrollment rises. At some point, in order to maintain a certain standard in terms of the variety and quality of courses offered, management of the university will seek to ensure that courses, staff and facilities keep pace with the growth in enrollment. At this point the decline in unit recurrent cost may slow down. Beyond a certain level of enrollment, there may even be some tendency for unit recurrent cost to increase. Pressure to diversify courses leading into greater specialization may imply a lower student staff ratio; the institution may encounter incremental costs in management overhead expenses; existing physical

Figure 3.1 Plot of Unit Recurrent Cost versus Enrollment[a]



[a] Legend:
A = 1 observation, B = 2 observations, etc. Total number of observations is 136

World Bank—30052:5

facilities may be expanded but at some cost in congestion on an existing campus. When these constraints impose a significant price, the recommended decision would be to set up a second institution. Once again diversification of courses coupled with specialization among institutions could further lower the overall unit cost. Ultimately further expansion of university enrollment could take the form of duplication, with numerous large institutions offering rather similar programs. In this case one would expect to find an average cost curve which is quite horizontal at high levels of enrollment. The scatter diagram in Figure 3.1 reveals this general shape. Although the proportion of institutions with total enrollment above, say, 6,000 is small, in general terms the picture supports the conclusion of a decreasing cost function of student enrollment.

3.07 Another way to assess the relation between enrollment and unit recurrent cost of universities is to estimate the relation mathematically. Table 3.3 shows the summary estimates for cost functions using the data set of 136 universities. (A full discussion of this analysis including the mathematical treatment is in Annexes B and D.) The dependent variable is average recurrent cost as measured by total recurrent expenditure divided by the total number of students. Equation 1 reveals a significant recurrent cost function estimated by controlling for kind of institution. All independent variables are significant at the 1% level and $\bar{R}^2$, which measures the fit of the function to the data, with 1.00 being a perfect fit, is 0.60. Equation 2 also makes use of the student teacher ratio and shows a significant fit at the 5% level. All other independent variables remain significant at the 1% level and $\bar{R}^2$ is 0.61. The fit of the functional forms used in Equation 1 and Equation 2 is generally better than that of other functions reported in Annex D. These equations also correspond well with the intuitive notion that the decline in average costs would be progressively smaller with increases in enrollment and that authorities would eventually tend to expand enrollments by duplicating existing facilities.

3.08 The estimate of student teacher ratio provides a powerful explanatory variable. This ratio is important not only for its impact on the variability in university costs among institutions, but also for the size of its effect on costs. Although personnel costs are a relatively lower share of total recurrent expenditure of universities in China -- in other countries personnel costs in universities commonly represent between 60% and 70% of recurrent expenditures -- the earnings of teachers are still a major component of total recurrent cost. The main reason is the very small ratio of students per teacher in Chinese institutions, averaging about 3.7 to 1 for 136 universities providing data. This is perhaps the lowest ratio in the world. The average for East Asia and the Pacific excluding China is about 12 to 1; for Sub-Saharan Africa, 10 to 1; the United Kingdom, 12 to 1; the United States, 15 to 1; and France, 25 to 1.[15] The ratio of students to total staff in Chinese universities is, of course, even slightly lower, an average of

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15/ Mingat, A. Education Financing and Policy in Africa, draft, Education and Training Design Division, Economic Development Institute. World Bank, Washington, D.C. 1985.

DATA SET = POOLED SAMPLE FROM APPRAISAL REPORTS,
ANNUAL REPORTS AND QUESTIONNAIRES
Number of observations = 136

Table 3.3: AVERAGE COST FUNCTIONS
[Dependent variable: unit recurrent cost (Y)] /a

	(1)	(2)
Constant	1,801.5 (13.4)/b	2,024.6 (12.1)/b
Inverse of total enrollment (ENT3INV)	$9{,}676.5\times10^{4}$ (7.2)/b	$9{,}024.2\times10^{4}$ (6.8)/b
Student teacher ratio (SRT3)	-	$-3{,}861.5\times10^{-2}$ (2.5)/c
Agriculture-related (NKIND1)	$-9{,}262.4\times10^{-1}$ (6.1)/b	$-9{,}806.2\times10^{-1}$ (6.5)/b
Science and technology (NKIND2)	-1,017.9 (6.7)/b	-1,056.4 (7.1)/b
Economics, finance, law, political science (NKIND3)	-1,448.0 (5.7)/b	-1,331.9 (5.2)/b
Comprehensive (NKIND4)	-1,279.0 (7.4)/b	-1,235.4 (7.3)/b
Normal (NKIND5)	-1,270.7 (7.7)/b	-1,235.0 (7.6)/b
$\bar{R}^2$	0.60	0.61
F	31.4/b	29.1/b
Number of cases	136	136

/a Unit recurrent cost is measured as total recurrent expenditure divided by the total number of students, or AVC3 as defined in Annex B.
/b Statistically significant at 1%.
/c Statistically significant at 5%.

Note: Figures in parentheses are /t/ ratios.

about 1.3 to 1. It stands to reason that even moderate increases in this ratio could generate considerable savings.

3.09 Altogether the estimated average recurrent cost functions, reported in Table 3.3 and Annex D, are largely consistent with conventional economic theory, which generally precludes the possibility of observing average cost curves that are continually rising or take the form of an inverted 'U'. Rather, a conclusion of this analysis is that average recurrent costs decline over the range of enrollments under consideration, and that these universities are operating on the declining portion of the average cost curve. The analysis also suggests that the average cost curve is downward sloping and continues to decline but at a decreasing rate.

Simulations of Average Recurrent Costs

3.10 By use of the estimated average cost functions, it is possible to test the effect on unit recurrent cost of certain changes in the explanatory variables such as kind of institution, size of enrollment, student teacher ratio. For the sample of 136 institutions, Equation 2 of Table 3.3 was adopted for the simulation exercise. The results are reported in Table 3.4. For each of the six kinds of institutions, enrollment was allowed to range from 500 to 15,000. The student teacher ratio was also adjusted from the mean for the subset to 8.0, an approximate target set by SEdC for reform of universities in China by the year 1990, and to 12.0, closer to an international average.

3.11 The results of this exercise are instructive. The case of agriculture-related colleges with enrollment of 2,000 students and average student teacher ratio of 3.2 is chosen as an example. In this case average recurrent cost is Y 1,372. If enrollment is doubled, the average cost declines to Y 1,146 or by 16%. If the student teacher ratio is increased to 8.0, the average cost falls to Y 1,186, a decline of 13%. If these measures are taken simultaneously -- doubling of enrollment and an increase in student teacher ratio to 8.0 -- then the average cost falls to Y 961, or by a total of 30%. This same pattern is sustained for the other kinds of institutions. The results reported in Table 3.4 indicate that the simulations demonstrate quite powerful effects for increases in enrollment and increases in student teacher ratio. The possible error of estimation in the simulations is, of course, much less when the explanatory variables are near the mean or within sample ranges. The tails of the distribution, especially the larger values for enrollment and student teacher ratio would yield less accurate estimates. But even with simulations within observable ranges of enrollment and reasonable student teacher ratios, the estimated level of savings is quite high.

Implications for Management and Finance

3.12 This chapter has examined the structure of recurrent expenditures in conventional universities and reported the results of an attempt to estimate the relation between enrollment and unit recurrent cost in the operation of different kinds of universities in China. It also reports on a simulation of the effect of increases in enrollment and in student teacher ratio on recurrent costs. The findings relate to several areas of policy for higher education management and finance.

DATA SET = POOLED SAMPLE FROM APPRAISAL REPORTS,
ANNUAL REPORTS AND QUESTIONNAIRES
Number of observations = 136

Table 3.4: SIMULATION OF UNIT COST BEHAVIOR /a
EFFECT OF STUDENT TEACHER RATIO AND ENROLLMENT (Y)

	Agriculture, forestry, fishery, meteorology, hydrology, N = 50			Science and technology, N = 33		
	Student teacher ratio			Student teacher ratio		
Enrollment	Average = 3.2	8.0	12.0	Average = 4.1	8.0	12.0
500	2,725.26	2,539.91	2,385.45	2,614.72	2,464.13	2,309.67
1,000	1,822.83	1,637.48	1,483.02	1,712.30	1,561.70	1,407.24
2,000	1,371.62	1,186.27	1,031.81	1,261.09	1,110.49	956.03
4,000	1,146.02	960.67	806.21	1,035.48	884.89	730.43
6,000	1,070.82	885.46	731.00	960.28	809.68	655.22
8,000	1,033.21	847.86	693.40	922.68	772.08	617.62
10,000	1,010.65	825.30	670.84	900.12	749.52	595.06
15,000	980.57	795.22	640.76	870.04	719.44	564.98

Table 3.4: (cont'd)

	Economics, finance, law, political science, N = 4			Comprehensive, N = 17		
	Student teacher ratio			Student teacher ratio		
Enrollment	Average = 8.3	8.0	12.0	Average = 6.5	8.0	12.0
500	2,177.04	2,188.63	2,034.17	2,343.05	2,285.13	2,130.67
1,000	1,274.62	1,286.20	1,131.74	1,440.63	1,382.70	1,228.24
2,000	823.41	834.99	680.53	989.41	931.49	777.03
4,000	597.80	609.39	454.93	763.81	705.89	551.43
6,000	522.60	534.1	379.72	688.61	630.68	476.22
8,000	485.00	496.58	342.12	651.01	593.08	438.62
10,000	462.44	474.02	319.56	628.45	570.52	416.06
15,000	432.36	443.94	289.48	598.36	540.44	385.98

Table 3.4: (cont'd)

	Normal, N = 21			Medical, N = 11		
	Student teacher ratio			Student teacher ratio		
Enrollment	Average = 6.3	8.0	12.0	Average = 5.0	8.0	12.0
500	2,351.17	2,285.53	2,131.07	3,636.37	3,520.50	3,366.07
1,000	1,448.75	1,383.10	1,228.64	2,733.95	2,618.10	2,463.64
2,000	997.54	931.89	777.43	2,282.74	2,166.89	2,012.43
4,000	771.93	706.29	551.83	2,057.13	1,941.29	1,786.83
6,000	696.73	631.08	476.62	1,981.93	1,866.08	1,711.62
8,000	659.13	593.48	439.02	1,944.33	1,828.48	1,674.02
10,000	636.57	570.92	416.46	1,921.77	1,805.92	1,651.46
15,000	606.49	540.84	386.38	1,891.69	1,775.84	1,621.38

/a Average recurrent cost is measured as total recurrent expenditure divided by the total number of students, or AVC3 as defined in Annex B.

Note: N = number of observations within each category.

3.13 Although personnel costs in universities in China -- about 37% of total recurrent expenditure -- are not high by comparison with other countries, policies to increase the very low student teacher ratios common throughout Chinese universities would produce substantial savings. Low student teacher ratios in China derive from several historical conditions that have resulted in inefficient use of available teaching personnel: the decline in enrollment during the period of the Cultural Revolution; the hiring of large numbers of teaching assistants during the same period; the fact that many senior faculty members and professors have not been fully active in teaching or research; many others have had low qualifications for academic work; the absence until recently of a policy for compulsory retirement; and the previously accepted low teaching load of, say, four to six hours per week for many teachers. These conditions have now begun to change. New hiring is more selective; programs for faculty upgrading are in place at all institutions; new policies for retirement are in effect; and planned teaching loads are increasing to the range of 15 to 18 teaching hours per week. SEdC is implementing these changes guided by a target student teacher ratio of about 8 to 1 by 1990, with further increases possible in the 1990s. At the same time, SEdC has developed an overall consensus within the Government to increase the remuneration of education sector personnel, in part, as compensation for increased workloads and, in part, as a measure to improve the status of teaching in an effort to attract able and qualified personnel. Policies to increase the very low student teacher ratio in the future could be combined with increased pay without significant impact on total recurrent costs.

3.14 Another area concerns the substantial support provided university students by way of operation of student residences and stipends for food and other allowances. In the institutions that completed the questionnaires, this form of spending on students amounted to about 20% of total recurrent expenditure. Recurrent expenditure related to student boarding combined with various kinds of student subsidies increase recurrent costs and, quite obviously, limit proportionately the capacity to provide more student places. Although student residences are considered necessary by most university personnel -- given average housing standards and the relative lack of alternative arrangements for students -- they also represent an additional drain on capital budgets. But alternatives have proved possible in the case of polytechnics that provide no residential accommodations. The experience of these institutions, as enrollment has grown by 50% since 1981, is that the absence of student residences has not been an insurmountable barrier. Likewise major universities in Beijing, Shanghai and Shenyang, to identify a few locations, have also recognized that the demand for higher education is sufficiently high that students and their families are willing in many cases to seek out and make alternative plans for accommodation at the promise of university admission. In order to protect the interests of qualified students from poorer families in any policy to limit university-supplied residential accommodations, available space could be allocated on the basis of need as estimated by household income, commuting distance, and so on.

3.15 By the same token, fees and related student charges for university education deserve review. Indeed, the Government announced in May 1985 that a plan would be developed gradually to reduce grants and subsidies, that some students, in particular those sponsored by work units or admitted outside the state plan, would be charged fees, and scholarships based on academic performance would be more widely offered. There are sound reasons for some movement in this direction in higher education in China. The promised reforms in pay policy will likely increase the benefits that accrue to university graduates during their employment. In addition, that students and families can tolerate fees at the post-secondary level is demonstrated by the rapid expansion of fee-charging, nonresidential polytechnics, and of specialized courses at regular universities for which fees are already applied to students. The private costs of education in China have long included fees and related charges. The structure of such private expenditure by level of education is shown in Table 3.5. The estimates for fees are averages which can vary by province, county and by state-run or locally financed schools. At the higher level, fees and related private expenditure are nominal in relation to total expenditure per student -- about 1%. At the primary level, particularly in rural village-run schools, fees and related charges to households, may be a significant share, about 30%, of total expenditure per student. Lower secondary students who must live in residences, particularly students in some rural areas, have to provide themselves about ¥ 50 to 60 for food and related requirements. In contrast, residential students in many upper secondary schools and in higher education are generally provided state subsidies to cover such costs. Policies to reduce direct subsidies to students at the university level as well as recover partial costs of university education could result in additional resources for further expansion of higher education or for investment in lower levels of education.

3.16 On the basis of information currently available, the social effects in China of an increase in the proportion of non-residential, day-students and of greater sharing of costs of higher education between academic institutions and students (or their families and employers) are not entirely clear. A thorough-going analysis would require reliable data on distribution of income and on distribution of household expenditure by level of education attained, say, by the head of the household. It would also require estimates of future changes in income distribution as a result of changes in pay policy. Although reliable estimates of such information are not available for China, the implications of education finance arrangements on social equity in other countries may be instructive. In general, public subsidies to education in developing countries are distributed inequitably. The relatively few individuals who are able to reach higher education receive very large unit subsidies compared to those who only attain lower levels, and this should be judged in the light of evidence from other countries that higher income groups are over-represented among those who attain higher levels of education.16/ The disparity across levels of education in the distribution of unit subsidies for China and major world regions (relative to per capita income) is shown in the first three columns of Table 3.6. The subsidy per student increases rapidly with the level of education. This pattern is most pronounced for African countries, where the unit subsidies in higher education are 28 (francophone

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16/ This discussion draws on (draft) The Financing of Education in Developing Countries, Education and Training Department, World Bank, Washington, D.C., September 1985.

Table 3.5: PRIVATE EXPENDITURE PER STUDENT PER YEAR ON FEES, TEXTBOOKS AND MATERIALS (Y) 1984.

	(1) + (2) Total	(1) Fees /a	(2) Textbooks and materials /b	Expenditure for residential students
Primary	6-9	2-3	4-6	-
Lower secondary school	12-17	4-5	8-10	50-60/c
Regular upper secondary school	17-21	5-6	12-15	(50-80)/d
Specialized upper secondary school	17-21	5-6	12-15	(200-300)/e
Higher education	20-26	5-6	15-20	(200-300)

/a Fees vary by county and by schools within county. They include both a tuition fee and a class fee, and occasionally fees for water and fuel.

/b Includes both prescribed textbooks, which are required for school attendance, and writing paper and materials, pencils, etc.

/c In village or township (rural) middle schools with boarding, students are generally charged this amount.

/d In regular upper secondary schools students may receive boarding allowances averaging Y 5 to 10 per month.

/e In specialized secondary schools (agriculture, technical or secondary normal schools) and in higher education institutions students, all boarders, may receive subsidies or allowances of between Y 20 to 25 per month.

Source: Mission estimates.

Table 3.6: PUBLIC EDUCATION SUBSIDY AS PERCENT OF GNP PER CAPITA AND EDUCATIONAL ATTAINMENT OF THE POPULATION, CHINA AND MAJOR WORLD REGIONS, CIRCA 1980

Region	Unit subsidy as percent of per capita GNP			Percent of each generation attaining: /a			
	Primary	Secondary	Higher	No schooling	Primary education	Secondary education	Higher education
China /b	8	24	216	25	65	10.3	0.7
Anglophone Africa	18	50	920	23	60	15.8	1.2
Francophone Africa	29	143	804	54	32	11.6	2.4
South Asia	8	18	119	29	52	14.6	4.4
East Asia & Pacific	11	20	118	13	44	33.9	9.1
Latin America	9	26	88	10	46	32.0	12.0
Middle East & North Africa	12	28	150	18	46	26.6	9.4
Developing countries	14	41	370	25	47	22.0	6.0
Developed countries	22	24	49	0	20	59.0	21.0

/a Refers to the highest level of educational attainment obtained in public schools.

/b Data on educational attainment in China are taken from 10% sample of 1982 census.

Source: Mission estimates for China and Education and Training Department, World Bank for major world regions.

Africa) and 50 (anglophone Africa) times those in primary education. The impact of these large differences in unit subsidies is reinforced by the fact that relatively few people have access to the high unit subsidies, since in most developing countries few members of any generation eventually attain higher education. The result is shown in the last three columns of Table 3.6. The discrepancies are again largest in Africa: less than 3% of each generation receives subsidized higher education, whereas nearly 40% receives no schooling. For the developing countries as a group, only 6% of each generation is likely to benefit from higher education, whereas 25% have had no schooling at all. Quite obviously, the distributional impact of these financing arrangements are exacerbated by the fact that higher income groups are generally over-represented at higher levels of education.

3.17 What is more, in most countries, the highest social returns to education based on measurable monetary rewards is at the lowest level.[17/] Thus, in most developing countries, one way to increase the equity and efficiency of a public education system is to impose selective charges at the higher levels of education and redistribute the revenue to the lower levels. Such an approach would be equitable because the state subsidies would be redirected from relatively more affluent to the less affluent groups. It would also be efficient because it would permit expansion of what is generally estimated as the most productive education investment in developing countries, namely primary schooling or basic education. Given the heavy subsidization of higher education in many developing countries, therefore, this level of education is the natural starting point for raising charges in education, either through reduction in student allowances or through charges for services provided.

3.18 An important caveat is, of course, necessary concerning the possible equity effects of raising charges for higher education. Notwithstanding the gains of redistributing resources to primary or basic education in most developing countries, within higher education the increase in private financing will adversely affect some students: poorer students may be forced to terminate their higher education program; others may be discouraged from applying for university admission. It is generally recognized that such effects could be mitigated through the provision of selective scholarships, through fee exemption for low-income students, or through the institution of educational loan schemes that are common in other countries.[18/]

3.19 For China, the analysis of these issues depends on both economic and social considerations. These include the nature of proposed reforms in pay policy, in systems for allocating university graduates, and in the evolution

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[17/] Psacharopoulos, G., "Returns to Education: A Further International Update and Implications," Journal of Human Resources, Fall, 1985

[18/] For an analysis of such arrangements see, for example, Woodhall, M., Student Loans as a Means of Financing Higher Education: Lessons from International Experience, Staff Working Paper No. 599, World Bank, Washington, D.C., 1983.

of social policy with respect to provision and financing of health care, housing, social security as well as education. What is clear at present is that the Decision on Reform of Education of May 1985 confirms the judgment gradually to reduce certain subsidies for higher education, to increase scholarship assistance based on merit, to apply selective fees and charges while providing exemptions for needy students, and to seek full cost financing for sponsored students and for additional students who may seek admission at the university of their choice once the authorized quota of entrants are admitted under the centralized admissions examination. Charges for tuition and for boarding, food and other costs, combined with selective scholarships and exemptions for poorer students are in the direction of reforms proposed or underway in a wide range of other developing countries.

3.20 In addition to questions of personnel costs and deployment, and student subsidies, this chapter has examined questions of unit recurrent cost as a function of size of enrollment. It has concluded that unit recurrent cost is closely related to the size of enrollment and that there are substantial economies of scale in university operations in China. Unit recurrent cost appears to decline or remain approximately constant after a much higher level of enrollment is reached. The information in Table 3.4 suggests that there are significant savings in terms of lower average unit cost up to a level of about 8,000 to 10,000 students. Further expansion would lead to less substantial reductions. Quite obviously, the optimal size of enrollment for a given kind of university cannot be judged solely on the basis of recurrent expenditure. The cost of land must be taken into consideration. So must the unit capital costs for universities of different kinds. That unit capital costs are also subject to change as a declining function of enrollment in China is already recognized by the Construction Bureau of SEdC. It reports, for example, for purposes of facilities design, average space allowance for an undergraduate student for science and engineering is 38.0 m^2. But for enrollments between 3,000 to 5,000 students, it is 37.4 m^2; and for enrollments above 5,000, the per student space standard is 34.5 m^2. Typical classroom and laboratory space planning in other countries also reflects a parallel reduction in per student space requirements with increasing enrollment. What can be concluded from the analysis of this chapter is that if, on considering capital expenditure on land, physical plant and equipment, an even larger size is recommended, there would be no significant loss of efficiency in terms of average recurrent cost by exceeding the 8,000 to 10,000 threshhold. There is little tendency for the average recurrent cost curve to be U-shaped implying rising unit recurrent cost after some optimum enrollment level.

3.21 The implications of this finding for the development of higher education in China are quite clear. Larger universities can be operated more efficiently than smaller ones at least with respect to recurrent costs. The planning of universities should give priority to expanding existing institutions or only building new institutions that would operate with enrollments considerably larger than is currently the norm in China. Where smaller institutions operate in close proximity, say, in large cities, planning for future expansion should include the possibility of consolidating existing institutions under a single administration.

IV. ANALYSIS OF CAPITAL INVESTMENT AND PHYSICAL PLANT MANAGEMENT IN UNIVERSITIES

Introduction

4.01 Efficiency in the management of higher education concerns not only measures to reduce recurrent costs, but also to improve the productivity of capital investment in physical plant and equipment. Higher education in China has entered a period of rapid growth. Enrollments may increase five-fold between 1983 and 2000. New investment in plant and equipment could total about Y 25 billion (in 1983 prices) over the same period. At this projected rate of increase in enrollment and possible level of aggregate capital expenditure, measures to reduce unit capital costs could have widespread impact and assist greatly in meeting enrollment targets. The financial requirements for upgrading existing and building new facilities and for acquiring new equipment will compete with other pressing tasks such as faculty training, provision of educational materials, and development of library collections. These claims on available resources for higher education will force hard choices in allocating university budgets. They will also challenge planners and managers of higher education institutions in China to re-examine some long-standing practices and procedures with respect to the planning and management of physical facilities in a search for possible savings.

4.02 This chapter examines current practices within Chinese higher education in several areas of physical plant management. These encompass: facilities planning and design; facilities management, including both scheduling and utilization of space and procedures for management of equipment; maintenance and operation of facilities; and, finally, aspects of training and organization for physical plant managers and related personnel.

4.03 In addition, the chapter identifies several areas for change and improvement. Procedures in place for many years for planning new facilities have depended on a system of per student space standards. A comparison of these standards with those that have applied in World Bank projects or in a set of developed countries indicates that savings may be possible. Furthermore, space standards are a less valid guide to space requirements for planning additions to existing facilities or for designing more complex institutions offering a wide range of courses, enrolling students on a credit system and engaging in research activities. With respect to physical plant management, action is required to improve the utilization of existing facilities to help meet current space shortages and reduce the need for additional construction. Although new procedures for equipment operation and maintenance are in place in many institutions, further improvements are possible. In addition, many campuses have a significant backlog of unfunded maintenance and repair of physical facilities, and programs for facilities maintenance should be strengthened. Finally, changes in the organizational structure for physical plant managers and the provision of training could help improve management performance, conserve investment in higher education facilities and help provide a suitable environment for academic and research programs.

Facilities Planning and Design

4.04 This section examines the Chinese system of per student space standards for planning new facilities requirements and identifies areas for possible improvement in overall facilities planning and design.

4.05 Facilities Planning. The Bureau of Construction of SEdC has an overall responsibility for the establishment of educational facilities standards. These are applicable to planning of institutions under the direct control of SEdC, as well as those under the management of ministries and provincial governments. The facilities standards used by SEdC are essentially based on a per student space allowance. This space allowance is subdivided into shares for each major category of facility usually required at a higher education institution. In 1980, the Ministry of Education established a series of per student space standards for several principal categories of undergraduate and graduate enrollment.19/ An allocation of 38.0 m^2, for example, was established as an average for undergraduate science and engineering students. Table 4.1 shows a breakdown of space standards by major categories within academic and administrative use, communal use and other use (faculty housing). Similar average standards established for other categories of students include the following: undergraduate liberal arts, 33 m^2 per student; graduate liberal arts, 45 m^2 per student; and graduate science and engineering, 50 m^2 per student. In the allowances for graduate students, the additional space allotment is largely determined by increased library and laboratory space.

4.06 Table 4.1 illustrates quite clearly that non-academic facilities for support and service functions are a significant share of total space allocation. For example, faculty housing, dining halls, and schools for children of employees account for 32% of the total space allowance for science and engineering undergraduates. If allowance for student dormitories and canteens is added, this category accounts for about 50% of total space. This significant level of space allocations for non-academic facilities reflects a historic pattern since the 1950s of development of "closed" institutions in China, very nearly self-sufficient in the provision of supporting facilities and services such as faculty and staff housing, primary and secondary schools, health care facilities, printing plants, and other services. While the relative lack of adequate supporting services outside the higher education institutions originally necessitated this policy, the development of the Chinese economy is beginning to provide alternatives to such self-sufficiency.

19/ See (draft) School Building Space Planning for Regular Institutes of Higher Education, Ministry of Education, Beijing, 1980. See, also SEdC average space standards provided to the mission. These are recommended by SEdC for calculating per student capital costs when universities expand facilities to accommodate students to be trained under contract. (Draft) Annex I, Recommended Standards for Capital Construction, MOE, Beijing, 1984.

Table 4.1: CHINA: SPACE STANDARDS - AVERAGE RECOMMENDED FOR SCIENCE AND ENGINEERING UNDERGRADUATES
(m^2)

	Space allocated per student
Academic and Administrative Use	
Classrooms, all types	3.40
Library	1.31
Department administrative use	0.88
University administrative use	0.65
Laboratory and workshop	8.00
Test and analysis center	1.00
Communal Use	
Sports facilities	0.39
Students' dormitory and canteen	7.30
Canteens for faculty and staff	0.23
Welfare and accessory space	2.15
Underground shelter	0.70
Space for commercial services; primary and secondary schools	1.30
Other Use	
Faculty housing	10.69
Total	38.00

Note: Space standards are expressed in gross m^2. Net usable space is about 60% of gross.

Primary and secondary education is fully provided in urban and the more developed rural areas. Health care facilities are widely distributed. In larger cities, housing is beginning to be developed in some cases as a municipal responsibility. Likewise, a wider variety of services is increasingly provided by units under state agencies, by collectives or individuals. The cost of building facilities for these supporting services represents a significant limitation upon the rate with which expansion in higher education capacity can be achieved. At the same time, both the managerial effort and the cost involved in operation of such facilities represents a substantial diversion of the resources available for a university's academic and research programs.

4.07 For budgetary purposes cost estimation for new facilities is based upon unit construction cost standards established by SEdC. Examples of current standards are as follows: undergraduate and graduate science and engineering students, Y 300 per m^2; and undergraduate and graduate liberal arts students, Y 280 per m^2. These standards are adjusted slightly for regional variations in cost. Because of variations in weather conditions, and consequently in building heating requirements, unit construction costs are modified for zones south of the Changjiang (Yangtze River), where no heating facilities are provided; another unit cost is applied from north of the Changjiang to south of the Huang He (Yellow River); and another for locations north of the Huang He, and locations in northeast China north of Shenyang. An example of the regional variations in unit construction costs are the cost standards for student dormitory construction: coldest area, Y 200 per m^2; middle area, Y 150-160 per m^2; and warm area, Y 140-150 per m^2.

4.08 While the use of fixed per student space standards for facilities planning is simple and provides a common guide, it also has several shortcomings. First, under the current approach, institutions are apparently not obligated to establish a total requirement for each space category (based upon, for example, specifications of the educational program, the planned number of students and the established space allocation), which is then measured against an existing inventory of space to determine a net deficiency for new construction.[20] While several universities in China have indicated that this is done in some manner, it is not required as a formal part of the facilities planning process. And it is not necessarily reflected in budget requests for capital construction. A possible consequence is that, in the absence of accurate estimates of the stock of existing facilities, net new construction planned may be more than is actually required to sustain the additional enrollment.

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[20] Such an approach is recommended in the publication: Planning Buildings and Facilities for Higher Education UNESCO, Paris, 1976. This document explains in detail several stages of planning and design for establishing net space requirements by category of facility. An example of incorporating such precise educational program specifications into accommodations planning is found in World Bank, Indonesia Polytechnics II Working Papers, 1982.

4.09 Second, utilization of the number of students as the primary basis for determining requirements will become increasingly unworkable as reform and growth significantly change the nature of China's institutions of higher education. So long as universities are primarily academic in nature, have comparable student teacher ratios, and are attended by full-time, resident students, a per-student space allocation may be an adequate basis for planning facilities requirements. But changing student teacher ratios, the growth of sponsored research, growing numbers of nonresident, commuting and part-time students, and any movement toward the provision of some supporting services from sectors outside the university will significantly affect an institution's requirements. An inflexible space standard based upon student enrollment cannot adequately provide for these variations. Consequently, for many categories of facilities, approaches that use micro-level analysis of requirements for specialized facilities may be necessary for planning the many categories of university facilities for which requirements are not directly linked to the number of students.

4.10 Third, although the space standards for many categories generally appear to be reasonable, and in some cases even austere, some of these standards may actually provide for more space than is strictly needed. Several sources report information on per student space standards in higher education.[21/] The World Bank has determined unit areas for university academic and administrative, and communal facilities financed under World Bank projects. The median per student space allocation for universities included in these projects is an average of 17.0 m^2 per student. This is 76% of the space allocated under the Chinese standards for science and engineering undergraduates, 22.3 m^2 (not including space for student dormitories and faculty housing) and 93% of the space allocated under the Chinese standards for undergraduate liberal arts students, 18.3 m^2 (not including student dormitories and faculty housing). Per student space standards in universities elsewhere are reported as follows: average for public universities in South Korea, 10 m^2; average for private universities in South Korea 9, m^2; average for universities in West Germany, 16.3 m^2; Tokyo University in Japan, 24.1 m^2; Indiana University in the United States, 16.9 m^2; University of Illinois in the United States 15.6 m^2; University of Paris IV, France, 16.4 m^2; and University of Grenoble I, France, 15.9 m^2. Of course the Chinese space standards that include faculty housing, 33 m^2 per science and engineering student (but not including student dormitories) and 28 m^2 per arts student (not including student dormitories), appear even larger by comparison.

[21/] See Unit Area and Unit Cost Estimates in Education Projects, Education Department, World Bank, Washington, D.C., 1983; and A Study on the Optimal Standards for Higher Education Facilities in Korea, Summary, Korean Council for University Education, Seoul, 1985.

4.11 Another comparison is possible using space planning guides for specific categories of use typical of many countries. Table 4.2 is a comparison of the per student classroom and laboratory space standards for science and engineering students in China with requirements based on space planning guidelines representative of standards used elsewhere. The standards and approach used in Table 4.2 were developed for public universities in the State of Virginia in the United States, but are broadly representative of other states, and also of Canada, the United Kingdom and Australia.[22/] The calculations for these comparisons are shown in Annex E.

4.12 Table 4.2 provides several different bases for comparison. A comparison of the first three standards indicates that the basic SEdC standard for science and engineering students, 3.40 m^2 per student for classroom space and 8.00 m^2 per student for laboratory space, without any adjustment for differences in average student hours per week or level of utilization, provides for about 100% to 200% more classroom space, and about 100% to 600% more laboratory space, than is provided at a typical public university elsewhere. Three alternative estimations were then made by taking into consideration student hours per week and levels of space utilization. Alternative I estimates per student Chinese space allocation requirements based on Virginia guidelines, with no adjustment in reported student contact hours or in level of utilization. Under this approach, that would allocate 2.37 m^2 per student for classroom space and 10.45 m^2 per student for laboratory space, the space provided by the SEdC standards is seen to be about 40% higher for classroom space and about 20% lower for laboratory space than would be made available if based upon typical North American guidelines for public universities. The substantial variation here results from differences in average weekly student contact hours between the typical North American university and the average Chinese figures. Average student contact hours per week in North American public universities are: in classrooms, 13.5 hours in arts and sciences and 10.7 hours in engineering; and in laboratories, 0.9 hours in arts and sciences and 3.9 hours in engineering. By comparison, in Chinese universities, average student contact hours per week in science and engineering are reported in classrooms, 21 hours and in laboratories, 7 hours.

4.13 Under the assumption that there will be some shift from classroom contact hours to more independent study with the current trend in China to a credit hour system, a further calculation, Alternative II, was made based upon projected Chinese university averages of 18 weekly student hours for classroom space and five weekly student hours for laboratory space. In this case, the space provided by the SEdC standards is about 2.03 m^2 per student for classroom space and 7.46 m^2 per student for laboratory space. This is about 60% to

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[22/] The space planning guidelines used are from the State Council of Higher Education for Virginia (SCHEV). They are entitled Fixed Assets Planning Guidelines and Special Requirements for Institutions of Higher Education, 1986-88 Biennum, 1984, SCHEV.

Table 4.2: CHINA: SPACE STANDARDS COMPARISON, SCIENCE AND ENGINEERING STUDENTS
(m^2)

Standard	Space allocated per student Classroom	 Laboratory
Chinese actual SEdC average space allocation for science and engineering student	3.40	8.00
Public university space allocation for arts and science student, based on Virginia guidelines /a	1.48	1.35
Public university space allocation for engineering student, based on Virginia guidelines /b	1.18	4.27
Alternative 1: Chinese average space allocation for science and engineering student based upon current average student hours per week, current levels of space utilization, and Virginia guidelines	2.37	10.45
Alternative 2: Chinese average space allocation for science and engineering student based upon revised average student hours per week, current levels of space utilization, and Virginia guidelines	2.03	7.46
Alternative 3: Chinese average space allocation for science and engineering student based upon revised average student hours per week, improved space utilization, and Virginia guidelines	1.05	2.91

/a State Council for Higher Education Virginia.

/b Virginia standards distinguish between students in arts and sciences, and students in engineering.

100% higher for classroom space and between the Virginia space allocations for science and for engineering students for laboratory space.

4.14 Finally, an estimation of Chinese space requirements, Alternative III, was made based on both revised average student hours per week and improved levels of space utilization using the Virginia guidelines. Under these assumptions, projected classroom student hours per week are 18 and laboratory student hours per week are 5. Also, with 25% improvement in space utilization, the following levels are achieved for science and engineering undergraduates: 75% for classrooms and 50% for laboratories based on a 60 hour timetable of 8:00 AM to 6:00 PM Monday to Saturday (see para. 4.21). Under these assumptions, space standards applied by SEdC could be reduced: for classrooms, from 3.40 m^2 per student to 1.05 m^2 per student; and for laboratories, from 8.00 m^2 per student to 2.91 m^2 per student.

4.15 Annex E also contains an estimate of the magnitude of cost savings that could be achieved through such a revision of standards. Based upon current construction cost norms, these potential savings are estimated at about Y 2,300 per student, or, on the order of a reduction of 20% in the capital cost of the construction of facilities required to support increased enrollment. While exact comparisons are difficult, these alternatives suggest that a careful review of the adequacy of SEdC space criteria may provide opportunities for reduction in the facilities that must be constructed to support the planned increase in higher education enrollment.

4.16 Facilities Design. While recognizing that savings may accrue by virtue of reducing certain space standards, university planners must also recognize that a more developed university system will undoubtedly require greater diversity and variation in university facilities. Space standards in other countries are guides for planning, but they are not rigidly applied under all circumstances. The same flexibility in facilities design is undoubtedly needed in China. The current process for planning facilities typically provides for a "planning report" or "preplanning study." This is a basic description of the planned project and is used to establish a budget. It is developed into completed working drawings and specifications from preliminary drawings prepared in a process comparable to that used in other countries. University design is the responsibility of design institutes which may be units of a provincial or municipal government, or a technical ministry, or may be affiliated with a university. These design institutes are adequately staffed with experienced professionals and are capable of competent design work. Where the design of highly specialized and complex facilities for academic and research purposes is required, however, personnel of these institutes would undoubtedly benefit from opportunities to exchange experience with their counterparts in other institutes and to participate in study visits abroad where similar facilities have been successfully designed and constructed. As the same time, restriction of specialized design work (for example, high technology laboratories) to a limited number of design institutes should serve to increase the experience level in the design of specialized facilities.

4.17 In comparing design standards in different universities in China with institutions abroad, several areas were identified for possible improvement or introduction. These include:

(a) more study hall or library reading room space to provide student study space as an alternative to students' use of classroom space when classes are not in session;

(b) more flexible "generic" laboratory space suitable for teaching use for several disciplines. This would also facilitate necessary improvements in laboratory utilization; and

(c) improvement of comfort standards, in noise level reduction, lighting standards, and other design features that would provide surroundings more conducive to teaching and study.

There is, undoubtedly, an important role for the SEdC Construction Bureau in the development of recommended design standards for various types of educational facilities. Such revised approaches could help to improve the overall quality of new facilities, and may help reduce the cost of construction.

4.18 Facilities Construction. China's institutions of higher education have long used an approach to construction of facilities under which projects are assigned to an available construction team and a contract negotiated for performance of the work. Such a procedure is inherently noncompetitive and does not provide significant incentives to the construction team to increase the efficiency of its work, to reduce costs, or to complete projects in a timely manner. Institutions relying upon this procedure have reported problems of both cost and delay in the construction of capital projects.

4.19 Beginning in the second half of 1984, SEdC initiated competitive bidding for construction projects, under which both local construction units and those from other areas would submit bids for projects. A pre-qualification procedure has been used to ensure that construction units have adequate resources and experience. Such competitive bidding has been used for recent projects at a major university in Tianjin and at a university of finance and economics in Shanghai, among other cases. Most universities under SEdC control are beginning to utilize competitive bidding, and its adoption by institutions under ministries and provincial governments is also in progress. Experience with competitive bidding to date has been largely favorable. Construction costs have been reduced by an estimated average of 10%; construction force efficiency has increased; and construction has been accomplished more rapidly. The option of competitive bidding has thus far proved infeasible in some areas where there is an insufficient number of construction organizations, and they are already fully committed to available projects.

4.20 In several locations with major construction projects, university officials have expressed concern about the quality of new construction work. This problem is attributed to the rapid increase in construction projects nation-wide in 1984 and 1985 and the related scarcity of supplies, materials, support services and utilities, and technical and skilled manpower. Government has taken action in 1985 to control and effectively limit for a period the development of new projects that would place additional strain on the construction industry. The problem of inadequate quality in ongoing construction projects will only be solved on a broad national basis through management, supervision, and training improvements in the construction industry. In order to avoid the undesirable effects of poor construction, universities will need to provide strong supervision and inspection of construction projects by their own construction management teams.

Facilities Management

4.21 Facilities Utilization. Although SEdC does not receive utilization reports from institutions, SEdC officers have advised that, as a result of new guidelines for classroom and laboratory utilization, overall utilization has recently improved significantly. Prior to recent improvements, utilization rates were reported at about 50% of the hours available during the normal daytime period. The SEdC has now set higher standards of six hours per day for classroom space and eight hours per day for laboratory space. These standards, however, are based upon occupancy and not necessarily actual class hours or laboratory contact. Observations based on visits to universities in several regions of China indicate that actual teaching use for classrooms is about five hours per day and teaching use of instructional laboratories about four hours per day.

4.22 Management and utilization procedures for teaching space vary significantly among institutions. At some institutions, classroom and some laboratory space is centrally managed, typically by an academic dean or a corresponding level. In other institutions, perhaps the majority, classroom space is essentially allocated to the department. Under a traditional method of classroom utilization still employed at many institutions, each class of students has its own permanently-assigned classroom. All classes are taught in that classroom, and the space is utilized for student study during periods when classes are not being conducted. Under this method of utilization, one classroom is required for every class. At larger institutions or at institutions where enrollment growth has exceeded the availability of classroom space, a more conventional system of assignment and utilization is in use, with classes being assigned to available classrooms for each actual class requirement.

4.23 At many institutions the use of more flexible systems of classroom assignment and utilization, in place of the permanent assignment of a classroom to each class, is handicapped by the lack of alternative study space for students. Dormitory rooms are in general not adequate for student study periods. Some institutions have established large study halls or utilized large lecture halls for study purposes when they are not required for lectures. This system permits a more intensive utilization of available classrooms for actual teaching purposes. The use of library space for reading and study purposes is effectively restricted at many institutions by the relatively limited number of hours during the week that libraries are open. At several institutions, an encouraging trend to extended library hours was noted.

4.24 In order to assess the actual level of classroom and laboratory utilization, several institutions were asked to complete utilization surveys. Examples of these are included in Annex F. These surveys indicate the number of classrooms or laboratories in use during each class period throughout a typical week. Since distinctions do not appear to have been made in all cases between study use and actual teaching use, or between laboratory preparation and actual teaching utilization, these summaries probably overstate the level of utilization. However, the data provide several indications:

(a) utilization of academic classrooms averaging about 70% is high throughout the morning hours, but is much lower during afternoon hours;

(b) laboratory utilization presents a less clear pattern but utilization rarely exceeds 70%;

(c) at virtually all institutions, there is a long lunch and rest period -- effectively two to two-and-a-half hours -- during which classroom and laboratory facilities are not in use; and

(d) at most institutions, utilization of both classroom and laboratory space becomes quite low during the late afternoon, evenings and weekends.

4.25 Examination of the data would indicate that more intensive utilization of available space could be achieved through some modification to the traditional patterns of academic timetables -- for example, by scheduling: (a) both academic classes and laboratory classes on a more uniform basis throughout the morning and afternoon; and (b) variable lunch periods for faculty and students so as to permit use of classroom and laboratory space during the traditional long lunch period. (Such a change could also serve to reduce the required scope of food service facilities.)

4.26 Almost without exception -- in China or elsewhere -- those institutions which centrally manage classroom space assignment are able to achieve a higher level of utilization. Consequently, central management and assignment of space could be made the standard procedure for all institutions. To the extent that this task is centrally managed in universities around the world, it is usually assigned to a dean of studies or an academic vice president. The use of computers, which are becoming increasingly available to all institutions, could also greatly strengthen and simplify the assignment and scheduling process.

4.27 Equipment Management. In recognition of certain weaknesses in the overall management of laboratory equipment, the Ministry of Education created in 1982 a Laboratory Management Division within the Production and Supply Bureau. The duties of this division include the establishment of uniform procedures for the management, utilization, and maintenance of equipment. Guidelines have been set and specific management procedures for instruments and equipment, and regulations for laboratory work, have been published.[23] These measures establish a sound basis for improved utilization and maintenance of laboratory equipment, and should greatly improve the return on investment as they are applied.[24] Nevertheless, progress is still required in several areas at individual institutions. For many standard requirements, central testing and analysis centers would more efficiently supply scientific support services than laboratories managed by individual departments. At some institutions utilization of equipment is unduly limited by procedures that restrict access to scheduled use. Sharing of computer services has not progressed sufficiently to ensure in all cases high levels of utilization and avoidance of duplication of computer services within departments or colleges. Further progress in these areas would be possible with the support of the Production and Supply Bureau of SEdC and with opportunities for study visits within China and abroad for responsible university personnel.

4.28 Maintenance Management. The combination of the neglect of many educational facilities during the Cultural Revolution and a continuing shortage of resources sufficient to carry out maintenance programs have produced in many institutions a significant backlog of deferred maintenance--that is, maintenance and repair, which is currently required, but for which funds are not available. Average annual expenditure on maintenance alone within Chinese universities is difficult to estimate because separate maintenance budgets and accounts are not generally kept. Table 3.1 reports that, in universities completing the questionnaire prepared by Bank staff, an average of 13% of recurrent expenditure is devoted to materials and supplies not directly related to instruction and to maintenance of grounds, buildings and equipment. It is not possible to separate further from this proportion strictly maintenance-related expenditure. However, examination by Bank staff of facilities in several universities has indicated that maintenance expenditure is typically devoted to cleaning, replacement of consumables or servicing of major units of power, water or heating. In many cases other requirements are not met out of annual recurrent expenditure. A major university of business and economics reported a backlog of maintenance and repair of approximately Y 2.5 million, for a total facilities inventory of 71,000 m^2. Based upon an estimated average planned replacement cost of Y 280 per m^2, this maintenance and repair backlog is equivalent to approximately 12.5% of the university's plant replacement value. This is a deferred maintenance level of approximately 25 times what is generally considered by university plant administrators in the United States, Canada and the United Kingdom to be an optimum level (0.5% of planned replacement value). A technical university reported a deficiency of Y 30 million for deferred maintenance and repair and required improvements for a total facilities inventory of 376,000 m^2. Under the assumption that approximately half of this deficiency represents deferred maintenance and repair, and that an average plant replacement cost is Y 300 per m^2, this deferred maintenance backlog is equal to approximately 13% of plant replacement value, or 26 times an optimum level. The most favorable situation reported was at a provincial university, where an unfunded maintenance and repair backlog of Y 1.1 million was reported for an inventory of 173,000 m^2. Based upon an assumed average plant replacement value of Y 300 yuan per m^2, this backlog equates to about 2.0% of plant replacement value.

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[23] Management Methods for College and University Instruments and Equipment; Provisional Regulations for College and University Laboratory Work, and College and University Management Methods for Materials, Low-Value Goods and Consumables, State Education Commission, Beijing 1983.

[24] An excellent discussion of management of educational equipment programs, including discussion of organizational approaches in a number of countries, is provided by a recent UNESCO publication: The Educational Administrator and Instructional Materials, Paris 1984.

4.29 These sample data, as well as an inspection of facilities by the mission, suggest that there is a significant deferred maintenance problem at most institutions. Experience at universities in other countries has demonstrated that deferral of maintenance results in an escalation of the original maintenance cost at an exponential rate. If deferral of needed maintenance lasts sufficiently long, total cost will exceed by a considerable margin the cost that would have been required to maintain the facilities at an adequate level (see Annex G, Figure G.1).

4.30 Maintenance management practices and systems vary widely among universities in China. While there is a general awareness of the fundamental principals of maintenance management, most institutions indicate that limited budget for maintenance has not permitted the establishment of adequate facilities inspection, preventive maintenance, or other recognized maintenance management practices. Despite these constraints, improved maintenance practices have been implemented in some cases. A major normal university, for example, reported on the use of a system of time standards for maintenance workers that had been designed by the local municipality. A few major universities also developed regular maintenance inspection programs. However, an effective maintenance management program in all institutions should include each of the following:

(a) preventive maintenance: a system of scheduled inspection, service and minor repair for facilities and equipment, designed to insure that they are in good operating order and will function reliably;

(b) facilities inspection: a system of periodic inspection of facilities designed to evaluate conditions and to identify or project major required maintenance, repair or renewal;

(c) productivity standards: recognized time and cost standards for the performance of facilities work. These are typically used for planning and estimating work and for monitoring of performance;

(d) work planning systems: the development of budgets and work plans using the data developed in (a), (b), and (c); and

(e) employee training, development and qualification: programs to qualify employees in the basic skills required for facilities maintenance, and the additional skills and knowledge required for specialized educational and research facilities.

4.31 SEdC does not presently have capability for assisting in the development of such a maintenance program, much less for monitoring existing maintenance and repair at individual institutions. However, SEdC could assume a leading role in the development of standardized maintenance management procedures. The establishment of a new division, possibly within the Bureau of Construction of SEdC, that would be responsible for the development of maintenance management procedures, and capable of providing assistance in their installation at individual institutions, would be an appropriate response to this problem.25/

4.32 Altogether the development of new programs for educational facilities planning and management will require training for administrators. In other countries training of this kind is offered by government agencies (France, Federal Republic of Germany); specialized associations of physical plant managers (Canada, United States) or specialized committees of university officers (Australia, United Kingdom). In China this function could be assumed by SEdC bureaus, a special Higher Education Management Institute under SEdC or a leading academic institution, (see paras. 5.37 and 5.40), or by regional groupings of universities.

Facilities Organization

4.33 In most universities in China, the various facilities functions are placed under the management of a vice president for administration. Facilities planning and construction is organized separately from other facilities functions under a director of construction (or similar title) reporting directly to the vice president for administration. Most commonly, routine maintenance and operation of utilities plants and systems is included with other supporting services under the director of support services (or general services), also reporting to the vice president for administration. At a normal university in Beijing and a technical university in a provincial capital, facilities planning and construction was organized into a single facilities division which also included facilities maintenance and operation, all reporting to a vice president for administration. The advantage of this approach is that it combines all of the basic facilities functions under a single manager who reports directly to a vice president. This approach should be the standard for other institutions as well. A strong facilities manage-

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25/ An excellent reference to current practice in university management systems and practice, organization, and training and development for maintenance management is the text: Facilities Management: A Manual for Plant Administration, Association of Physical Plant Administrators of Universities and Colleges, Alexandria, Virginia 1984.

ment division is required in each institution in order to provide firm direction and high visibility to the overall needs of the facilities program. In most cases this division should be responsible for all aspects of the facilities program, including planning, design, construction, maintenance, and operations.

Conclusion

4.34 Practices in universities in China for planning, design and management of physical plant and equipment developed in the 1950s in response to rapid growth of higher education in that decade. These practices for facilities development and management were largely adopted from then current procedures in other sectors in China and were appropriate for the relatively small, self-supporting institutions of that era. Following the decline associated with the Cultural Revolution, higher education in China is now embarking on a major program of growth and diversification. To manage institutions effectively in this dynamic environment, and with increased efficiency in the use of capital resources, requires adjustment and improvement in practices and procedures. Based on the analysis in this chapter, there are several areas for consideration.

4.35 Planning of space requirements for universities in China has long depended on a system of per student space allocation. This system is simple and objective. But it also could be used to perpetuate a self-enclosed type of university campus, of a kind that may not be required in the reformed economic environment in China. The design of new university campuses and new facilities on existing campuses should increasingly take account of possible improvements in support services provided by the larger economy and the related prospect of not necessarily allocating space and resources for such functions. While certain supporting facilities and services represent important faculty and staff incentives, careful consideration should be given to the transfer of some functions of this nature to external institutions when they are able to provide an adequate level of service at less cost. There are currently successful efforts in several universities in China to utilize local community resources for some such requirements. A major medical university, in a large northern city, makes use of local primary and secondary schools for the children of faculty and staff. A normal university in a medium-sized city in the northeast has also been able to arrange schooling for children of employees in this way. A major technical university has located off-campus housing for a significant share of students, both full-time and part-time, as alternatives to construction and operation of these facilities by the university.

4.36 Quite apart from the need to review space standards in terms of the continuing justification for all of the components, space standards in use for planning universities in China raise other problems. The comparison with standards of space allocation under World Bank projects in other developing countries and in use in several developed countries suggests that per student space allocations in China could be reduced. What is more, with growth and diversity of universities, the rigid application of per student space standards is bound to prove unrealistic -- in net additions to existing facilities, in planning universities with students on a credit system, or in plans for universities with major research programs, to cite a few cases. In these circumstances emphasis in design work should shift to more micro-level analysis of specific requirements for accommodation of diverse university programs.

4.37 Design of new university facilities should also incorporate improvements that have been made in other countries. These include: more study hall or library reading room space to free classrooms for use in actual instruction rather than as student study areas; more flexible, multi-purpose laboratories; and significant improvement in comfort standards such as in noise reduction, lighting, and so on. SEdC Construction Bureau could assist in developing recommended standards in collaboration with design institutes specialized in university facilities. Opportunities for study tours to university campuses in China and foreign countries would assist responsible officers to incorporate design improvements in future construction programs.

4.38 Increased utilization of available space in universities would help accommodate more students in available teaching areas and reduce in some measure new space requirements. The achievement of higher levels of space utilization would require, in most cases, centralizing responsibility for class scheduling and classroom and most laboratory utilization under one academic officer of the university. The utilization of computers could also simplify the assignment and scheduling process that may become more complex under a credit hour system that is now proposed for many universities.

4.39 Management of teaching and research equipment has recently drawn the attention of SEdC, and new procedures have been established to improve management of equipment that is in the process of being introduced into many universities. Insistence on the application of these procedures and on further strengthening of the systems at each university by measures such as establishment of test and analysis centers, improved access to equipment for users from different university departments, and computer time sharing, should be on the agenda of the SEdC Production and Supply Bureau.

4.40 Maintenance of facilities and equipment suffers from lack of budgeted allocations and an underdeveloped system for management of maintenance and repair programs. Central authorities should encourage university officers to increase funding for maintenance services. Maintenance systems could be improved by development of maintenance criteria, standards and procedures to be applied in universities. This could be supported by establishing a new division in SEdC responsible for developing standards for and monitoring maintenance programs. A desirable organizational change within the universities is the centralization of all facilities functions, planning, design, construction, operations and maintenance, under managers who would all report to a senior officer, possibly a vice president in charge of administration (see also paras. 5.28-5.35 for other organizational changes).

4.41 Training and development of personnel responsible for all aspects of physical plant management is a relatively neglected area in China. In other countries this function is assumed by government agencies or by various professional associations. Leadership in this area in China could be taken up by SEdC either within existing bureaus or through a new Higher Education Management Institute under SEdC or a leading academic institution with strong leadership in the area of higher education management.

V. FISCAL MANAGEMENT OF UNIVERSITIES

Introduction

5.01 In any country the economic and social environment determines, in no small measure, the role and responsibility of higher education. In China this environment is changing rapidly and raises the prospect of major adjustments in higher educational institutions. Although the pace of economic system reform is not entirely clear, the direction of change is set. And the prospects are raised that changes already in train will have far-reaching impact on university operations, including their fiscal management. This chapter examines fiscal management and organization of universities in China in the context of these changing external circumstances -- under the assumptions, for example, that in the next 10 to 15 years:

(a) many universities will increase their enrollment substantially and new universities will be set up;

(b) universities will expand their teaching and research programs to offer a much wider array of courses and to engage in a much wider spectrum of research;

(c) personal and enterprise income will continue to rise and provide, in effect, new sources of revenue for university operations; and

(d) institutions responsible for health, education, housing and other services required by university personnel and for university operations will expand in size, in variety, and in the capacity to provide services which are, for the most part, currently provided by the universities themselves.

5.02 This chapter explores financial management of Chinese universities: revenue sources and classifications; uses of revenues for expenditures; budget classification systems; and comparisons of revenues and expenditures for specific functions or activities. It also examines activities of universities not directly related to their teaching and research programs. In addition, the chapter identifies several areas of possible change -- creation of accounts and reports manuals, establishment of an audit program, the creation of a more formal organization structure -- appropriate to a modern system of university fiscal management. Examples are presented to illustrate revenue and expense classification systems and reports which may be useful in modernization of financial operation. Adoption of systems of this kind would facilitate analysis of expenditures, cost of operations, relationships of revenue and expenditure by function, and other fiscal questions. Examples of organization charts are also provided in illustration of management structure appropriate to larger, more diverse academic and research organizations. The chapter concludes by examining possible support activities by the Government which may help strengthen the management of the fiscal affairs of the universities.

Revenue Sources and Classification

5.03 Revenues for the operations of universities and other institutions of higher education in China have been, until recent years, almost exclusively governmental. These governmental sources include the SEdC, the provinces, and technical ministries and agencies at national and provincial levels. With the changes that have taken place in the economic structure of China in recent years, many institutions, particularly the larger universities and the specialized universities of technology, have developed new sources of revenue. These derive from the acute need for specialized and technical personnel of many enterprises or governmental units and the willingness of these major entities to finance employees' education. Many of these units have developed contracts with universities for the training of their personnel. These training contracts are now providing an additional source of revenue for the institutions and for the faculty who teach the courses. At one comprehensive university in the Northeast, business enterprises in the area have agreed to pay Y 2,300 per student per year for training workers in special courses. Of this Y 2,300, Y 1,300 is used by the university to cover operating expenses and Y 1,000 is set aside for capital construction. The Y 1,300 is divided as follows: 40% to the university central budget to cover general administrative expenses; and 60% to the academic department responsible for the program for faculty support, department development, equipment funds and other departmental needs. In 1984, this source provided some Y 705,000 or approximately 7% of total recurrent expenditure.

5.04 In addition to the need for trained personnel, governmental units and enterprises increasingly require consulting and research services in fields such as technology development, marketing, application of computer technology, and management. Many universities are able to provide assistance in these areas, and governmental units and enterprises are now contracting with universities for these specific research needs. In a major university in the Northeast, these research funds in 1984 amounted to some Y 920,000, or about 9% of total recurrent expenditure.

5.05 Although full-time students in conventional universities in China have not paid fees or charges, according to the recent Decision on Education Reform students may now be admitted outside of the state planned enrollment quota, and charged fees. Other students who enroll in night courses, short courses, and correspondence courses are also charged fees. In some cases, the students pay these charges out of personal or family income. In other cases, enterprises will pay these fees in contribution to the upgrading of their employees. At a major medical university in north China, for example, evening students pay Y 340 per year for university courses if they are employed by an enterprise or Y 200 per year if they are not currently employed. Students who are employed may be reimbursed by their employer for these fees. To date, the amount collected at this university from this source amounts to about Y 40,000 per year, not a significant sum in comparison with total operating budget, but apparently sufficient to defray costs of new educational programs designed to serve local needs. In a major normal university in 1984, revenue from contract teaching, contract research, and from students outside the state plan amounted to some Y 800,000, compared with an allocation of about Y 7,000,000 from the Government for regular operations.

5.06 The sources outlined above are directly related to the basic teaching and research programs. There are also revenues which arise from activities carried on as auxiliary to the educational function. These revenues arise from the sale of books and materials to students; receipts from the operation of dining halls and guest houses; and revenues from operations of general stores and book stores by the university. Many educational institutions also operate printing presses for the printing and publication of textbooks and other instructional materials. These presses obtain income in the sales of their product to students, faculty and others. As a part of the laboratory training of students or the research interests of the faculty, some universities have also created "factory sales," that is, the manufacture of specialized equipment which is in demand by other universities or enterprises. A further source of revenue, of lesser amount now but a source which could grow in the future, are private gifts or contributions from a number of sources, overseas Chinese who wish to support a given institution, graduates supporting their university in partial repayment of the training they received, or enterprises contributing to the institution from which they obtain graduates.

5.07 At present these non-traditional sources of revenue amount to a small share of the operation of most universities. No one university is likely to incorporate all of these potential revenue sources in any one year, or over a period of years. Each of these sources, however, is now in use at one or more institutions in China. While it is expected that governmental units will continue to provide major amounts of revenues for the operation of universities, it is appropriate and desirable for universities: (a) to be aware of the possible sources of revenue other than governmental funds; and (b) to consider the practicality of developing these sources.

5.08 A major strength in the current system for fiscal management is the policy of carryover by the university of unused funds provided by the Government from year to year. This practice encourages universities to manage resources efficiently without the necessity to exhaust the budget within a given year. Further movement in the direction of greater responsibility and autonomy in fiscal management is envisaged under the recent Decision on Education Reform and is a welcome move. A major weakness is the general absence of a classification system that would provide for a careful accounting of revenues and expenditures and enable the university to determine the net cost of each activity and program. This requires revenues classified by different sources and expenditures classified in categories that can relate to management decisions.

5.09 In a year-by-year review by university officials of revenue sources for higher education, the share of total revenues from the major categories would be useful information. For example, what is the percentage of governmental revenues to total revenues and should this percentage be altered, up or down? Should enterprises which obtain the services of trained personnel pay more to the universities? An example of a revenue classification system which could provide information of this kind is presented in Table 5.1. It allows for study of the proportion of total revenues provided by Government, by level of Government and the proportion provided by nongovernmental sources. Also, as family incomes increase in China, it may be reasonable for students and

Table 5.1: SOURCES OF REVENUES FOR OPERATIONS

Source	1984 Actual		1985 Budget		Increase-Decrease		Remarks
	Amount	Percent of Total	Amount	Percent of Total	Amount	Percent	
Educational Activities							
1. State Government							
2. Province-Municipality Govt.							
3. Other Government							
Total Government							
4. Enterprises							
a) Personnel Training							
b) Research							
c) Other							
Total Enterprise							
5. Student Fees							
a) Special Courses							
b) Night Courses							
c) Correspondence Courses							
d) Other							
Total Student Fees							
Total Educational							
Auxiliary Activities							
6. Student Charges							
a) Meals							
b) Books							
c) Other							
7. Hospital Charges							
8. Factory Sales							
9. Press & Publication Sales							
Total Auxiliary							
Gifts and Contributions							
TOTAL REVENUES							

their families to pay fees or higher charges for meals, housing, school supplies and so on. The classification system in Table 5.1 opens up analysis of the total revenues for educational activities, what proportion is provided by students and what proportion is provided by enterprises and other economic units. It should not be taken as a model, but rather as an example of a classification of sources of revenues, showing actual, budget, amount, percentage, and changes from year to year. Each educational institution will have its own revenue sources, but all institutions using classified revenues of this general kind will be able to generate significant data for the analysis of fiscal operations on the revenue side.

5.10 Another reason for an improved system of revenue classification is the advantage of itemization of revenues from university factory sales, or student charges, for example, for dining halls, sports activities, or the sale of books from the university press. These activities all create expenditures and a distinct itemization of revenues could be compared with the expenditures for these revenue sources to determine the relationship of costs and revenues for activities.

5.11 Cost estimates are, of course, already used in China as guides for planning. The concept of standards for per student expenditure for all universities is used by the Finance and Planning Bureau of SEdC to determine annual support funds for the universities. A major technical university reports the use of unit cost standards of Y 1,600 per year for each additional undergraduate student, Y 4,000 per year for each additional graduate student, and Y 6,000 per year for each additional PhD student. Likewise the Construction Division in the Production and Supply Bureau of SEdC provides equipment funds in the amount of Y 2,700 per student for liberal arts undergraduates, Y 3,600 per student for science undergraduates, and Y 5,000 per student for graduate students. One problem is that accounting procedures in individual institutions are not able to provide a gauge as to the applicability of these standards.

Expenditures and Expenditure Classification

5.12 University expenditures may be classified and recorded in various ways. The system currently in use in Chinese universities is based on a classification of expenditures by object of expenditure, of which there are four main categories:

(a) personnel: (i) salaries of faculty and staff; (ii) benefits and bonuses for faculty and staff; and (iii) retirement;

(b) expenditures directly related to instruction (and research): (i) consumable materials; (ii) books; (iii) other consumables;

(c) expenditures not directly related to instruction (and research): (i) consumable materials; (ii) transportation; (iii) maintenance of buildings; and (iv) utilities; and

(d) student subsidies.

5.13 Table 5.2 contains the organization and listing of these expenditures as usually presented by universities. In most cases, this classification is all that is prepared. In some cases, supplemental schedules are prepared showing certain of these object categories, particularly expenditures directly related to instruction, for each teaching and research department.

5.14 While the data presented as shown in Table 5.2 are useful for gross budget control and for noting the relationship of personnel to nonpersonnel expenditures, they fail to provide answers to several important questions: What does it cost to educate a graduate in physics or mechanical engineering, or economics or finance? What does it cost to operate the middle school for faculty children? What is the cost of the university hospital?[26/] Questions of this kind relate to decisions within the university about allocation of resources among many possible uses. In the years ahead, universities will need to estimate more accurately the relative costs of various educational programs and auxiliary activities to determine an appropriate level of support. Knowledge of this kind could be obtained by the use of a functional classification of expenses and revenue. Such a classification system would not replace the object classification systems now in use, but would be in addition to the present cost systems.

5.15 A functional expenditure system would show for each major program or definable activity all expenditures for a given period of time directly assignable to the program or activity. These expenditures would include those shown in Table 5.2 Categories II and III as are directly assignable to each program. Table 5.3 is an example which accounts for these direct expenditures by major programs. For each program, the expenditures for personnel, consumable materials, books, other, and equipment are shown on each program line with a total for each program. In this case, the history department would have direct expenditures for all object categories; likewise, direct expenditures would be shown for the English, Chinese, and all other liberal arts departments. In this case the total of direct expenditures for the college of liberal arts amounts to Y 200,000.

5.16 In this example of a functional classification, Category I on Table 5.3 for educational programs should include all teaching units, colleges, or departments. If the university has not established intermediate college units, each department would be shown as a separate program. In the example of Table 5.3, the total direct cost for all educational programs is Y 1,400,000. Category II for research may be arranged by individual institutes or research projects, with as much detail as is useful. Each institute or project would show a total direct cost. In this case, the total direct cost for research is Y 200,000. Category III includes various programs indirectly related to the

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[26/] It should also be noted that this standard object classification apparently does not show equipment as an object of expenditure. Equipment needs are of such importance to the teaching and research programs and require substantial amounts of funds that it would be useful to add in Table 5.2 a classification for teaching and research equipment under Category II and for nonteaching equipment expenditures under Category III.

Table 5.2: EXPENDITURES BY OBJECT

Categories	Salaries	Subsidies	Benefits	Total	Budget
I. Personnel					
Administrative Staff	xx	xx	xx	xx	xx
Teaching Staff	xx	xx	xx	xx	xx
Caretakers, Kitchen, Drivers, etc.	xx	xx	xx	xx	xx
Total Personnel	xx	xx	xx	1,800,000	xx
II. Expenditures Directly Related to Instruction					
Consumable Materials in:					
Classrooms					xx
Laboratories					xx
Workshops				150,000	xx
Books and Other Reading Materials				80,000	xx
Other Consumables				40,000	xx
Total				270,000	xx
TOTAL DIRECT				2,070,000	
III. Expenditures Not Directly Related to Instruction					
Consumable Materials and Housing Supplies				300,000	xx
Transportation				80,000	xx
Maintenance of Buildings and Facilities				450,000	xx
Utilities				500,000	xx
Total				1,330,000	xx
IV. Student Subsidies				450,000	xx
ALL CATEGORIES, TOTAL				3,850,000	

Table 5.3: DIRECT EXPENDITURES BY PROGRAM

Program	Personnel (Salaries, Subsidies, Benefits)	Consumable Materials	Books	Other	Equipment	Total
I. Educational Programs						
1. College of Liberal Arts						
History Department	xx	xx	xx	xx	xx	xx
English Department						
Chinese Department						
Total Liberal Arts	xx	xx	xx	xx	xx	200,000
2. College of Science						
Chemistry	xx	xx	xx	xx	xx	xx xx
Biology						
Physics						
Total Science	xx	xx	xx	xx	xx	300,000
3. Others (each one listed separately)	xx	xx	xx	xx	xx	900,000
Total Education	xx	xx	xx	xx	xx	1,400,000
II. Research Programs						
1. Institute A	xx	xx	xx	xx	xx	40,000
2. Institute B						
3. Project 1						
4. Project 2						
Total Research	xx					200,000
III. Other Programs						
1. Primary Schools	xx	xx	xx	xx	xx	50,000
2. Middle Schools						
3. Hospitals						
4. Housing						
5. Printing Press						
Total Other						300,000
IV. General Overhead Programs						
1. General Administration	xx	xx	xx	xx	xx	250,000
2. Physical Plant				450,000		550,000
3. Utilities				500,000		600,000
4. Transportation				80,000		100,000
Total General Overhead	XX					1,500,000
V. Student Subsidies						450,000
TOTAL ALL EXPENDITURES	1,800,000	490,000	80,000	1,030,000		3,850,000

main functions of teaching and research but which are definable activities for cost purposes. The total direct cost for each program (primary schools, for example) is shown. Again, in the example of Table 5.3, the total direct cost for all of these programs is Y 300,000; Category IV includes the general overhead expenditures applicable to all items listed in Table 5.2 under Categories I, II, III, in the total amount of Y 1,500,000; and Category V shows the direct cost of student subsidies. Under this approach these direct program costs could be considered in connection with student enrollment figures for each college or department to project budget requirements, to compare the relative costs of such items as books and equipment between departments, or for other analytic purposes.

5.17 A second step in determining program costs is to prepare a total expenditure report for each program, including direct costs and general overhead expenditures assignable to the various programs. This step would allocate the general overhead items in Category IV of Table 5.3 to the programs listed in Categories I, II, and III. Table 5.4 is an example of how this might be accomplished.

5.18 The completion of Table 5.4 would require the use of appropriate coefficients to allocate the general overhead items to the major programs. Each overhead item would be looked at individually to determine an appropriate base for allocation. For example, physical plant maintenance is often allocated on the basis of the number of square meters used or by measuring the actual amount of heat, electricity, or water consumed by each program. Transportation expenditures could be allocated on the basis of kilometrage used by each program as a percentage of total kilometrage. General administration may be allocated on one of several possible bases: the personnel cost of each program, the total direct cost of each program, or other measurable and relevant basis. In this way, the university would possess an expenditure analysis for each major program or activity, showing the direct expenditures of each program as in Table 5.3 and the allocable portion of general overhead items added to direct expenditures in Table 5.4. In this illustration, the total of object expenditures of Y 3,850,000 in Table 5.2 is distributed to the major programs or activities, providing a program expenditure system for all expenditures of the university.

5.19 Program expenditure information could now be used in various ways. For example, costs of instructional programs would be very useful in considering the level of funding required to increase a specific program, such as physics, in comparison with the funding level required for history, or English, or Chinese language. In some cases, both direct costs and total costs of a specific program will be useful in considering alternative ways to accomplish a given objective. To a certain extent, general overhead costs are stable so that the addition (or deletion) of a specific program may have little or no immediate effect on overhead costs. For example, enrollment increases in a specific teaching department may have little effect on utility costs or general administrative expenditures. But the addition of a new department or a large increase in enrollment of a current department could increase certain of the general overhead expenditures. This could be determined by a specific analysis of the proposed change.

Table 5.4: TOTAL EXPENDITURES BY MAJOR PROGRAMS

Program	Direct Cost Appendix III	Allocated Costs				Total Cost
		General Adm.	Physical Plant	Utilities	Transportation	
I. College of Liberal Arts	200,000	20,000	40,000	45,000	7,000	312,000
II. College of Science	300,000					
⋮						
III. Institute A	40,000					
⋮						
IV. Primary Schools	50,000	5,000	10,000	11,000	2,000	78,000
V. Middle Schools						
VI. Hospitals						
VII. Housing						
VIII. Printing Press Dept.						
IX. Student Subsidies	450,000					450,000
Total	1,900,000	250,000	550,000	600,000	100,000	3,850,000

5.20 A similar approach could be adopted for the costs of programs not directly related to university teaching or research. For example, the total cost of the operations of the primary school shown in Table 5.4 is Y 78,000. Consideration could now be given to the question of the relative cost to the university in operating its own primary school or having the children of its faculty and staff attend primary schools operated by the local community. In this connection, attention should also be given to other costs required of the university to provide primary schools. These costs include land for playgrounds, construction funds needed for buildings and equipment, the administrative efforts required to manage a school, housing for teachers, and any other items of expenditure or effort which would not be required if the university did not provide a primary school. This kind of careful analysis could also be applied to the operation by a university of a printing press. What are the costs of a printing press including land, buildings, equipment, personnel, operating supplies, utilities, etc., and what is the output of the press? How do the costs per textbook printed by the university press compare with the costs which would be incurred if the textbooks were printed by a community printing plant? The university could carry out continuing analyses of all of the supporting or ancillary services, showing revenues obtained and expenses incurred. These analyses could then be used to assist the university in deciding how best to allocate its resources among all of the competing needs.

5.21 In these cost analyses of specific activities carried on by the university, any revenues associated with the activity should be applied to the costs of the activity, providing a net cost for comparison. Examples of such revenue arise in the manufacturing of laboratory equipment or in the operation of printing presses if sales are made to outside interests. Revenue from auxiliary activities are shown separately in the sources of revenue statement (or in a supplemental statement of details of revenues) to provide the information on revenues to prepare cost and revenue analyses on the programs or activities of the university. Sales of laboratory equipment should be carefully recorded by product to provide a comparison of revenue and costs. While the costs of making laboratory equipment, which may be sold at a later date, may properly be considered as teaching costs to train the students in the laboratories, it would still be useful to know the net cost (expenditure minus revenue) of this teaching effort and whether this net cost could be reduced by an increase in revenue or by a more efficient operation of the laboratory or be eliminated altogether.

5.22 In sum, with respect to expenditure analyses and revenue-cost comparisons for programs or activities carried on by the university, the universities should extend revenue and expenditure analysis by the preparation and use of supplemental, detailed fiscal statements. These would provide information for decisions by the university on efficient use of resources. The categories and classifications shown in Table 5.3 and 5.4 are not to be considered as models, but as examples. Each university would adopt its own formats appropriate to its programs, including any supplementary schedules which may provide further details on revenues and expenditures for any given program or activity.

Manuals for Accounting and Reporting of Fiscal Data

5.23 In recognition of the extensive development anticipated for higher education in China, it would be advisable to consider the preparation of accounting and reporting manuals covering the budgeting, accounting, and reporting of fiscal information. A manual of accounts and reports would be very helpful in establishing procedures to obtain comparable information for all universities. The Finance Division of the Finance and Planning Bureau of SEdC has issued a statement of principles and procedures for university fiscal management. This initiative could be extended to the preparation of appropriate manuals. The Ministry of Finance has established a Department of Accounting Affairs Administration to provide a variety of accounting systems for major areas of social and economic activity in China.[27/] It would be timely for SEdC to support the development of an accounting system within the nationwide system which would apply specifically to higher education institutions.

5.24 A manual of accounts and reports to be used by the SEdC, other levels of educational administration and all universities, would include a set of accounts for revenues, expenditures, and balance sheet for assets and liabilities. It would also include lists of subsidiary accounts for detailed data supporting the main accounts. In addition, such a manual would contain examples of fiscal reports to be used to report the results of operations and the balances on hand at the end of fiscal periods. It would also provide guidance to personnel in the fiscal offices of the universities in establishing adequate accounting systems and in the preparation of periodic reports.

5.25 Universities would not necessarily use all of the accounts and reports in a manual of accounts and reports. Each would use only those accounts and reports necessary to meet internal and external reporting requirements. What is accounted for and reported on, however, would be comparable among the various universities and would provide the SEdC and other agencies useful data. Since universities will continue to extend the use of computers in the accounting process and in the preparation of reports, the development of uniform and standard account structures and report formats, would lower the costs and expand the scope of computer-based accounting systems.

Audits of Accounts

5.26 SEdC and some of the universities have recognized the concept of auditing of university accounts for both internal and external purposes. This development should be encouraged. Internal audit reports would assist university managers by way of a detailed review of the implementation and effectiveness of the accounting and reporting system and an overall view of the fiscal management system of the university. Audit reports for external purposes

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[27/] Introduction to the Chinese Accounting System, Ministry of Finance, Beijing, 1984.

would assist SEdC, ministries and bureaus by providing a review of the application of uniform accounting and reporting procedures by the universities, and a review of the data provided by the fiscal reporting system.

5.27 A manual of accounts and reports setting forth the basic structure of an adequate accounting and reporting system would be a first step in the establishment of an audit program. On the basis of a standardized set of accounts and reports, an audit program could be developed to review the management of fiscal data in all respects, the recording of revenues and expenditures and of assets and liabilities; the existence of supporting vouchers, invoices, and other documents for expenditures; the extent to which decisions on the collection of revenues, the expenditure of funds, or the use of assets have been properly authorized; and the general level of managerial efficiency in the operations of the fiscal offices.

Organization for Decision-Making

5.28 Until recent years, the organizational structures in place in Chinese universities were simple and adequate. Since university personnel served under the several ministries of the central Government or the education bureaus of the provinces, responsibility for personnel was directly under the president's office. New buildings, laboratory renovations and equipment purchases were specifically funded by governmental authorities; and, consequently, were generally controlled by the president or an aide to the president. The purchase of consumable supplies and materials for all university operations was controlled by an administrative officer. Fiscal accounts and reports were simply structured to record expenditures by major categories of expenditure. Under these circumstances, the organizational structures of universities have been characterized by informality, some overlapping of responsibilities among the senior administrative officials, and vagueness concerning the delegation of authority. As long as the universities were small in size and relatively simple in the academic programs offered, these characteristics did not reflect a weakness in the management of their activities. Personal contact among the university officers and managers could offset the informality of the structure. With the growth in size and complexity of universities, it is necessary to look carefully at the structure of organization and delegation of authority within university administration.

5.29 Without a clarification of roles and responsibilities in many universities, the inefficiency of certain management practices would become burdensome. Overlapping of responsibilities, for example, will result in unnecessary administrative effort requiring excessive administrative personnel and uncertainty as to the precise focus of responsibility for specific decisions. The growth in revenues will require a more formal structure of responsibility than has been necessary in the past to be reasonably sure that all sources and amounts of revenues are developed, accounted for, audited, and reported to the president of the university and to the external authorities. And the growth in expenditures will also require more formal delegation of authority to be reasonably sure that all expenditures are properly made and adequately accounted for.

5.30 Many options exist as organizational models for the management of a growing university. One approach, by now typical of universities in North America, Western Europe and Japan, and many developing countries, is suggested in Figures 5.1 and 5.2. The first shows an organization chart for a small but growing university; the second is appropriate for a larger, more diversified institution. These charts are designed not only to identify offices but also to demonstrate relationships among university offices, particularly for the development of budgets and controls for revenues and expenditures. Authority and responsibility in a developing university may be separated into three main divisions: an academic division, that includes responsibility for academic personnel; a general administrative division for all non-teaching and non-research functions; and a development division to focus on relationships of universities with the local communities, enterprises and agencies, overseas Chinese and other individuals and agencies whose interest and support may provide assistance to the universities in the next several decades. These three major functions, each headed by a vice president, would also be the major focus for budget expenditure and controls. Each vice president would be provided with a budget in such detail as is useful for decision-making and control purposes. The academic function would have budgets for colleges and departments and research institutes or projects as in Table 5.3. The vice president for administration would manage a budget for each of the activities in the general administrative function; and the vice president for development or other vice presidential offices would manage budgets for their operating activities.

5.31 The budgets for each operating unit, college, department, institute, and so on, would be prepared in the first instance by the operating head of each unit. Preliminary budgets would then be reviewed by the next higher authority until a budget for the university for a given time period is approved by the president. The head of each operating unit would be responsible for the operations of the unit within the approved budget. The head of the unit would be responsible for the decisions necessary for the efficient operations of the unit.

5.32 The decisions at all levels of the organizational structure are, of course, subject to the review by the next higher authority, so that the president is ultimately responsible for management of the university. But the establishment of an organizational structure with clear lines of authority from the president's office to the next line of authority, and on down the line would provide the means by which decisions could be made at the appropriate operating level. Further, the participation of all levels of management of the university in the budget-making process, the careful review by each higher level of management, and the final adoption of a budget by the president would obtain the cooperation and best judgment of all levels of management in the preparation of the university budget.

5.33 The organization charts shown in Figures 5.1 and 5.2 are examples, the application of which would depend on the size and complexity of the university. The structures shown can be modified to emphasize different relationships in the various functions or activities. In some universities, graduate education may become a significant part of the educational programs offered to students. In these cases, it may be appropriate to assign a dean

Figure 5.1

University Organization Chart: Small Scale Institution

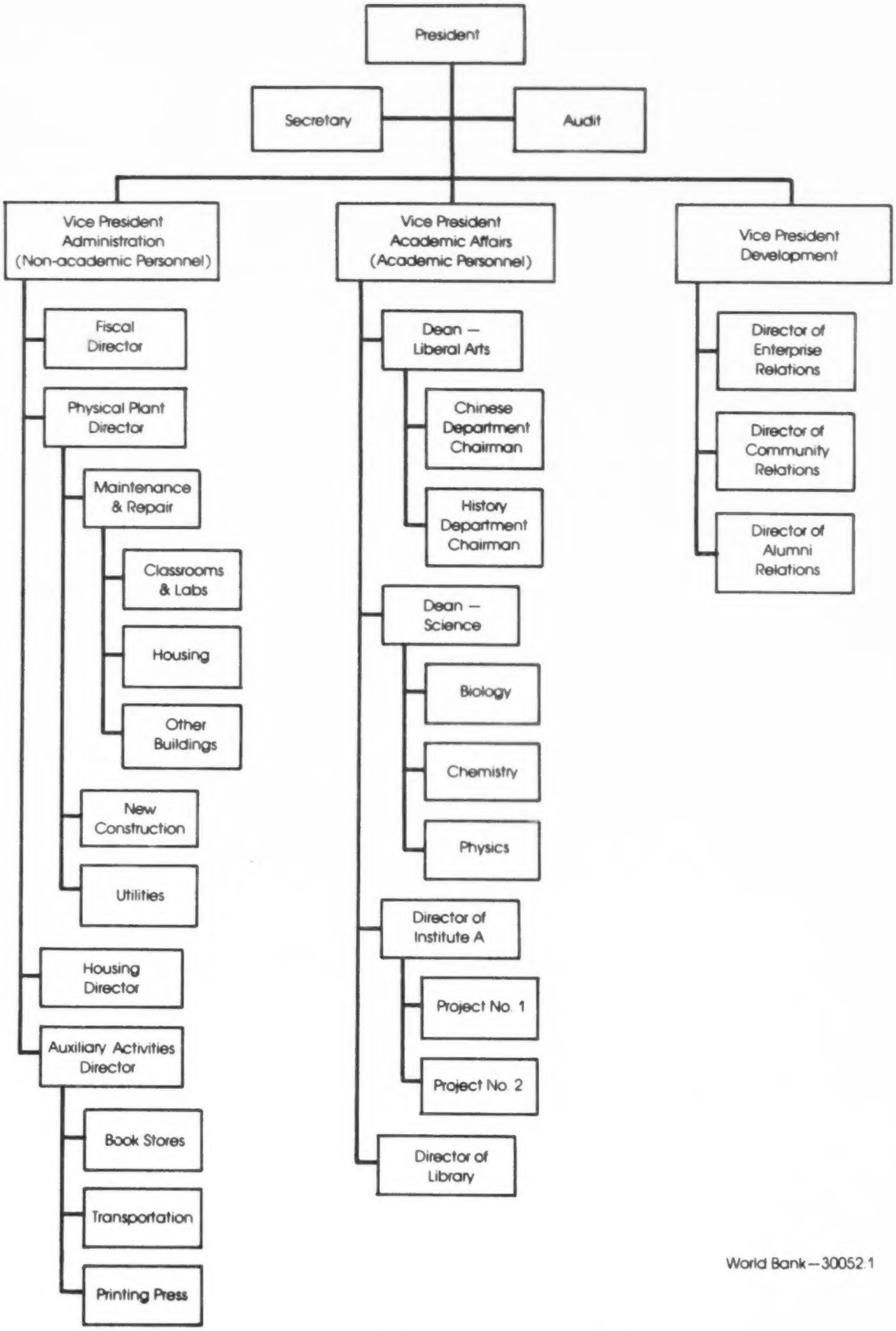
President
Secretary
Audit
Vice President Administration (Non-academic Personnel)
Fiscal Director
Physical Plant Director
Maintenance & Repair
Classrooms & Labs
Housing
Other Buildings
New Construction
Utilities
Housing Director
Auxiliary Activities Director
Book Stores
Transportation
Printing Press
Vice President Academic Affairs (Academic Personnel)
Dean — Liberal Arts
Chinese Department Chairman
History Department Chairman
Dean — Science
Biology
Chemistry
Physics
Director of Institute A
Project No. 1
Project No. 2
Director of Library
Vice President Development
Director of Enterprise Relations
Director of Community Relations
Director of Alumni Relations

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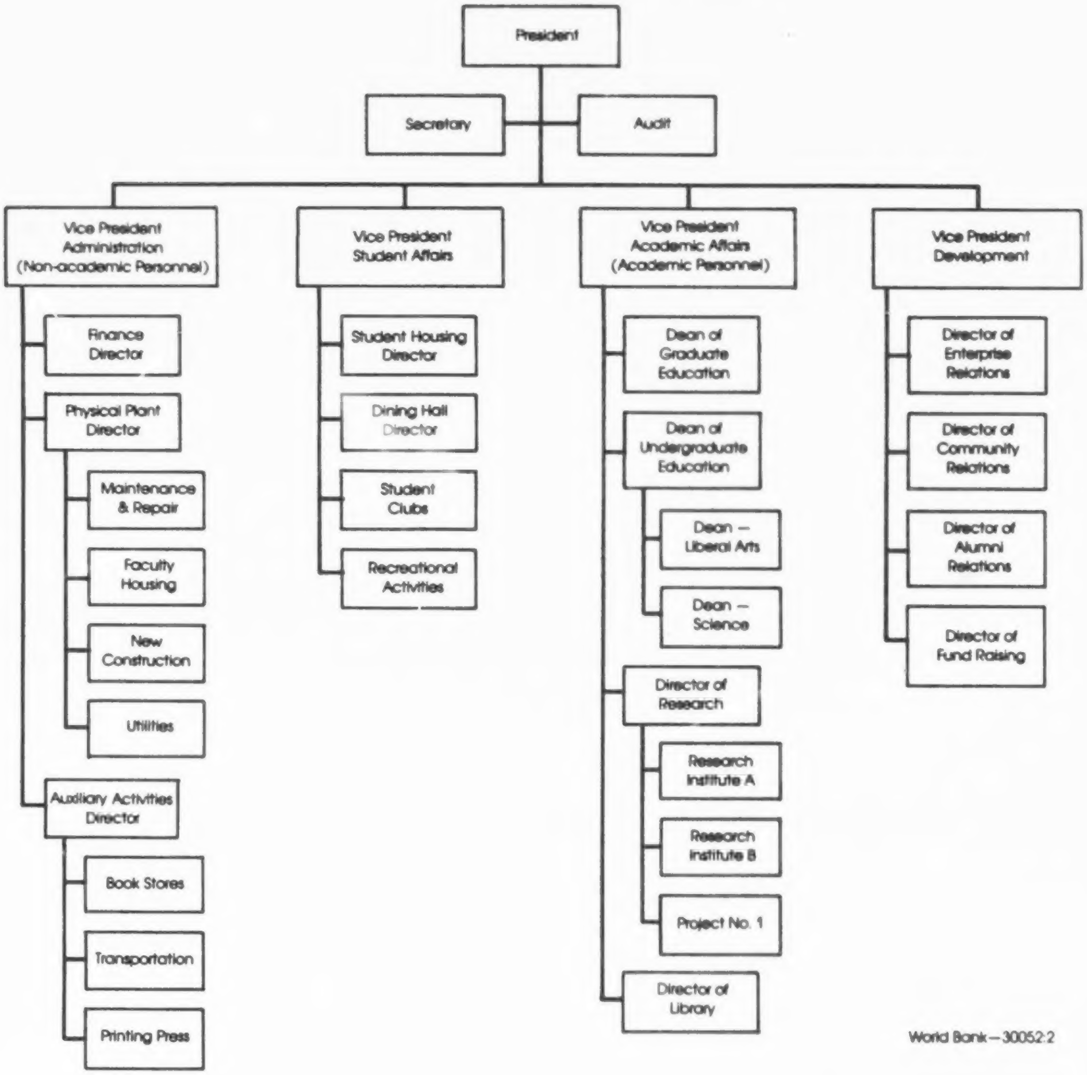
Figure 5.2

University Organization Chart: Large Scale Institution


President
Secretary
Audit
Vice President Administration (Non-academic Personnel)
Finance Director
Physical Plant Director
Maintenance & Repair
Faculty Housing
New Construction
Utilities
Auxiliary Activities Director
Book Stores
Transportation
Printing Press
Vice President Student Affairs
Student Housing Director
Dining Hall Director
Student Clubs
Recreational Activities
Vice President Academic Affairs (Academic Personnel)
Dean of Graduate Education
Dean of Undergraduate Education
Dean — Liberal Arts
Dean — Science
Director of Research
Research Institute A
Research Institute B
Project No. 1
Director of Library
Vice President Development
Director of Enterprise Relations
Director of Community Relations
Director of Alumni Relations
Director of Fund Raising

World Bank—30052:2

of graduate education and a dean of undergraduate education reporting to the vice president for academic affairs, with appropriate divisions or departments under each dean. In other universities, research activities have become a significant part of the educational programs. In these cases, it would be desirable to assign the management of these research activities to a director of research who would supervise the separately operated research projects.

5.34 As universities grow in size of student body, the increasing amount and complexity of student-related activities may require an administrative head for such activities. This head could be a dean of students or a vice president for student affairs, depending upon how much separate recognition the president and other administrative officers may wish to give to these activities. Among these activities would be student housing and dining facilities, recreational facilities and sports programs, student clubs and organizations, student discipline, scholarships and fellowships.

5.35 Finally, the organization chart would identify the creation of an audit function at the university level. Such a function would include responsibility for external audits to outside agencies, such as provincial or state bureaus of finance and education; for internal audits of university accounts and reports; and for advice and assistance to university operating units on proper and adequate accounting and reporting procedures.

Staff Training and Development

5.36 During the current period of reform and major expansion in higher education, the effective management of China's universities will require a substantial effort to improve the skills of administrators and managers and to introduce new management methods and systems. The implementation of revenue and expense classification systems; the assumption of decision-making authority by several levels of university management; the development of new relationships between the universities and other organizations and individuals, all of these new and enlarged activities will be significantly aided if there are training opportunities available for staff members responsible for these functions.

5.37 A program for staff training and development for university administrators and managers could be established through the following actions:

(a) designate selected universities for the initial introduction of new management methods and systems. It is envisioned that these institutions could then act as models for other higher education institutions in China;

(b) provide management training for fiscal managers in these "selected" universities as well as for appropriate officials at SEdC, ministries or provincial levels by: (i) conducting seminars for these managers, in China, by appropriately qualified and experienced managers from universities and organizations in China and abroad to introduce new management methods and systems; (ii) organizing study visits to foreign universities, in which the management methods and systems are well established and operating successfully; and (iii) preparing operating manuals in the appropriate bureaus or divisions of SEdC or other ministries, or with the assistance of consultants in public accounting, engineering, or management systems;

(c) eventually, expand the successful application of new management methods and systems from the initial set of "selected" universities to other universities by: (i) developing a Higher Education Management Institute under SEdC, or in cooperation with a leading academic institution, to provide periodic training in new methods of higher education management to managers and principal staff of China's institutions of higher education. Instructions would be provided by managers in the "selected" universities who have become experienced and successful in the application of new management methods and systems, by qualified personnel from SEdC, ministries, and by outside experts and specialists in various aspects of university management; and (ii) study visits by appropriate managers to "selected" universities; and

(d) establish regional associations of universities to promote short courses, institutes, conferences, and other training efforts on a regional scale. These associations could develop a variety of activities at the local or regional level which would supplement the activities of a Higher Education Management Institute.28/

Role of Central Agencies

5.38 Government agencies also have a role in improving university fiscal management through developing standards, manuals, and the promotion of training for university offices. The Department of Accounting Affairs Administration of the Ministry of Finance has been created to "institute an informed accounting system within the country and to administer the accounting work of the country." The scope of the system covers "nonbusiness unit accounting" and includes account classifications, accounting documents, financial statements, and other such records. Within this state-wide system, it would be appropriate and helpful for the Finance Division of the SEdC Bureau of Finance and Planning, working with the universities, to create a particular set of accounts, reports, and financial statements for universities to use in their financial management activities. In particular, the Finance Division could sponsor the preparation of an overall manual of accounts and reports for universities.

5.39 A second area of need in which the Finance Division of the Bureau of Finance and Planning could be of significant assistance is that of staff training and development. The Bureau could assist this effort, possibly working through a Higher Education Management Institute, by:

28/ Models for such associations exist in many countries including Canada, the United States, Australia, England and Japan.

(a) encouraging universities to conduct short courses and seminars in various regions of the country;

(b) providing staff of the Finance Division to conduct sessions at these seminars on accounting manuals, audit programs, budgetary procedures, and other activities of importance to both the Bureau and the universities;

(c) preparing training manuals and other materials which all universities could use for internal training efforts;

(d) providing funds for university staff members for travel and other expenses to attend training seminars; and

(e) developing relationships with organizations in other countries to learn about the activities in these countries to train and develop management staff.

5.40 A third area in which the Finance Division could develop specialized capability is in the development of functional costs and cost analysis statements. This would include: recommended organizational structures for universities; models of functional accounting classifications; financial statements based on functional revenues and costs; and special cost analyses to assist the universities to evaluate revenue and cost comparisons for specific activities and services of the universities.

Conclusion

5.41 Policies and procedures for the fiscal management of Chinese universities have been developed over the past several decades and have been appropriate for the stage of development of these institutions. At the present rates of growth and with the expected significant growth of universities to the year 2000, it is desirable to consider modernizing fiscal management policies and procedures. There are several areas for such consideration.

5.42 Until very recently, Chinese universities have been financed almost exclusively by government funds, provided by the central Government or provincial and municipal governments. Now, with increases in enterprise and personal income and the interest of many groups and individuals in the further development of university programs, efforts should be continued and extended to increase the funds available to universities from nongovernment sources. Enterprise contracts for training personnel and for research projects; charges to students and their families for meals, books, and other student expenses; contributions and donations from graduates, business enterprises, overseas Chinese, and other interest groups and individuals, all can become significant sources of revenues.

5.43 The budgetary system for the reporting of expenditures has been a simple classification of expenditures by object of expenditure; personnel costs, supplies, books, and materials for teaching and research units; supplies, materials, transportation, utilities as expenditures indirectly related to academic programs; and student subsidies. There are in use essentially no budgetary systems which reflect programmatic or functional expenditures. The current system is not useful for cost accounting and analysis. While sophisticated program budget systems are unnecessary and probably inappropriate, a simple classification system which shows costs by major programs would assist greatly the fiscal management of universities. Program costs as made available under a functional classification would help establish funding requirements for different kinds and levels of academic progams. They would identify costs of new research activities. They would promote the evaluation of auxiliary activities. And they would assist governmental bodies in planning for the fiscal needs of an expanding system of higher education. To support further improvement in university fiscal management, the development and application of a uniform manual of accounts and reports is warranted. Likewise, the introduction of an audit program covering the fiscal management policies and procedures is timely for both internal and external purposes.

5.44 University management in China would benefit by establishment of more formal organizational structures. This would require creating levels of responsibility and corresponding area of authority below the office of the president. Such a structure would be compatible with a budgetary system reflecting functional costs, would encourage the development of budgets from the lowest level of management up through each higher level of management, and would permit a delegation of authority for decision-making, while maintaining accountability.

5.45 The changes and improvements outlined in this chapter for the financial management of universities would depend, among other things, on availability of trained staff for administrative and managerial positions. The current limited supply of such staff argues for the creation of new opportunities for staff training and development. It also suggests an affirmative role in staff training and technical assistance for a Higher Education Management Institute.

VI. COSTS AND FINANCING OF HIGHER EDUCATION

Introduction

6.01 Reports in 1981 and 1985 on the Chinese economy by the World Bank analyzed the costs and financing of education in China. These studies concluded that, given the relatively high levels of primary and secondary education for a low-income country, the Government of China had spent less on education than could have been expected. Major reasons for relatively low educational expenditures were low teacher salaries and limited outlays for educational materials and buildings. Local communities, enterprises and, to some extent, parents had borne a fairly large proportion of costs at the primary and secondary level. Their ability to bear these costs had varied, however, and differences in enrollment and completion, as well as in the quality of primary and secondary education existed among localities. These studies also concluded that, in contrast to primary and secondary education, unit costs in higher education were high by the standards of other countries and could be reduced. Efficiency could be improved with better utilization of teaching staff and physical facilities.[29/]

6.02 Now the plans for developing higher education to the year 2000 are more defined. Enrollment targets have been set as a function of the 19-22 age group enrollment rates and in view of possible prospects for economic growth and adjustment and the demand for high-level manpower. This chapter reviews total spending on higher education and assesses the financial feasibility of ongoing and planned expansion of higher education.[30/] Figures used are based, in part, on reports of SEdC and agencies responsible for respective types of higher education and, in part, on estimates by World Bank staff from field visits or from questionnaires circulated to educational authorities.

6.03 The principal conclusion of this chapter is that the central scenario of medium growth in enrollment in higher education -- to an enrollment ratio of 12.5% by 2000 -- is basically feasible subject to two strong assumptions: first, that the plan to quadruple GVIAO by 2000 is realized; and, second, that there are significant improvements in internal efficiency and greater cost-sharing in higher education. The first assumption is beyond the scope of this study, but its realization has been judged as realistic in view of current performance and reforms in the Chinese economy. The second assumption is a central concern of this report. The conclusion here is that there is scope for significant increase in public finance of education. But, at the same time, in the absence of changes in internal efficiency and in

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[29/] China: Socialist Economic Development, Annex G: Education Sector, World Bank, Washington, D.C., 1981; and China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, op. cit.

[30/] The analysis is limited by the inadequate documentation of adult higher education costs and financing. For this subsector, unit costs have been estimated only from reports of aggregate expenditures and student enrollment.

greater cost-sharing for higher education, there is a clear risk that the projected public costs of higher education could absorb too large a share of total public resources for education. Under these circumstances, much-needed programs for improvement in the coverage and quality of basic education (primary and lower secondary), in upgrading teacher education, and in the vocational and technical thrust of upper secondary education may not be financed. In contrast, if policies to improve internal efficiency of higher education and to distribute more of the cost directly on the beneficiaries -- students, their families, or employing units -- are put in place, the burden on public finance would be reduced accordingly. Other priorities in Chinese educational development, such as those in basic, secondary vocational and teacher education, that must depend more heavily on public financing, could then more easily be addressed.

6.04 The Government of China has recently reported that in 1983 public expenditure on higher education was about 25% of total public spending on education.[31/] The share of recurrent expenditure on education by the central Government that is devoted to higher education has increased slightly in recent years. In 1979, about 19% was devoted to higher education; by 1983 the share was close to 21%. A similar pattern has probably followed in provincial government accounts, with the share allocated to recurrent expenditure on higher education climbing within the range of 15% to 20%. Total public capital expenditure on education is reported by the Government to have increased from 1979 to 1983 by about 120% in current prices.[32/] The increase in capital expenditure for higher education alone has been at least 220% over that period, so that the share of higher education in total public capital expenditure on education has also grown, to about 63%. This is much higher than previously estimated by the World Bank; and approximately double the estimated East Asia regional share of about 35%.[33/] It undoubtedly represents a backlog of capital expenditure requirements accumulated during the period of the Cultural Revolution.

Prospects to the Year 2000

6.05 The mission has projected public expenditure on higher education to the year 2000 in constant prices of 1983. The basis for these projections is threefold: target levels for enrollment in higher education according to type

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[31/] Achievement of Education in China, Statistics 1949-1983, Peoples Education Press, Beijing, 1985, pp. 371-372.

[32/] This is exceedingly difficult to measure accurately. Capital expenditure on education in China is accounted only under capital construction expenditure. A portion of primary and lower secondary school capital costs are financed locally and, in any case, fail to account for costs of volunteer labor for school construction. Further, much equipment and durable educational materials are charged against recurrent expenditure.

[33/] China: Long-Term Issues and Options, Annex A: Issues and Prospects in Education, op. cit., page 45-48.

of institution; estimates of development of the economy according to the three scenarios QUADRUPLE, MODERATE, BALANCE of the multisectoral model; and three alternatives for projecting public unit cost, 2000-I, 2000-II and 2,000-III, according to different policies on internal efficiency and distribution of financing of higher education. The three scenarios for the behavior of public unit cost are obtained as follows. Under 2000-I, salaries and related personnel costs are assumed to increase in line with the Government's goal for GDP per capita growth, that is 2.29 times 1983 levels. There are no departures from current practice in the internal allocation of resources to education or in cost-sharing arrangements. In this scenario, student teacher ratio, student residential accommodation and other subsidies, and unit capital costs are held to standards of 1983. Under 2000-II, the same adjustment is made in personnel-related costs as described above under 2000-I. But there is added: (a) a policy to improve the internal efficiency of regular academic programs by doubling the student teacher ratios; (b) a policy to increase further teachers' remuneration by 50%, in part, to compensate for a heavier work load and, in part, to improve the status of teaching; and (c) a saving of 20% in unit capital costs by means of adjustments in design of facilities and improved utilization of classroom and laboratory space.

6.06 Under 2000-III, the changes proposed in 2000-I and 2000-II are retained, but adjustments in cost-sharing are added. These include: (a) a decision to enroll up to 30% of full-time students in conventional universities as day students (no residential accommodations); (b) tuition fees and other charges are balanced by scholarships in conventional universities so that net income reaches 10% of recurrent cost, in the polytechnics these arrangements cover 20% of recurrent cost; and (c) correspondence, special and evening programs are operated so that 50% of recurrent costs are covered by sponsoring work units.

6.07 The policy changes under 2000-II and 2000-III are each consistent with the Decision on Educational Reform, May 1985 and other recent policy statements by SEdC. For example, SEdC has set a policy of increasing student teacher ratios to about 8 to 1 by 1990. Further adjustment beyond that level may be possible subsequently. At the same time, Government has announced that salary scales for personnel of the education sector are scheduled to rise faster than the general increase in salaries. Also university personnel will have access to bonus or supplemental income for additional teaching loads or for research or consulting contracts. Moreover, with respect to cost-sharing, the SEdC announcement of May 29, 1985 reported that there will be a gradual reduction in grants and subsidies to university students. Students who have the means will be required to pay a share of the cost of university education. Others will begin to pay nominal fees and some expenses. In the future, academic performance will be an important criterion in awarding scholarships. The actual percentages chosen for this simulation are, of course, only judgments by the mission of what might be reasonable.

6.08 Finally, to the estimates for public recurrent expenditure are added estimates for capital expenditure under two rubrics, capital construction and equipment. For the 1983 estimates, annualized expenditure on capital construction is estimated as 10% of recurrent expenditures for regular higher education and 5% for adult education. Annualized equipment requirements are based on SEdC norms and estimated as 20% of capital construction costs. Projections of annualized capital costs in 2000 are calculated on the basis of projected student enrollment. Under 2000-II and 2000-III, these estimates of aggregate annualized capital costs are reduced by 20% by reason of savings achieved through revision of space standards and other measures relating to improvements in design, utilization and maintenance of university facilities as identified in Chapter IV.[34]

6.09 The results of these projections of the medium enrollment target -- that would allow for an enrollment rate in higher education of 12.5% by 2000 -- are quite instructive. They are reported in Table 6.1. Under 2000-I, total annual public expenditure on higher education would grow by a factor of six (in constant 1983 prices) by the year 2000. In the QUADRUPLE projection -- essentially the Government's target of quadrupling the gross value of industrial and agricultural output between 1980 and 2000 -- this level of public expenditure on higher education would result in about 33% total public expenditure on education devoted to higher education. The current level is about 25%. Using the QUADRUPLE projection under scenarios 2000-II and 2000-III, which incorporate policies to reduce cost, the share of higher education in total public expenditure would reduce to 27% and 23% respectively. In the MODERATE projection -- that takes a less optimistic view of the future efficiency of the Chinese economy and projects lower growth -- the share of higher education in total public spending on education would reach very high levels of 49% under 2000-I, 42% under 2000-II and 35% under 2000-III. In this case of lower than expected economic growth, plans for expansion of higher education would probably have to be sharply curtailed, below the target of 12.5% enrollment rate. In the BALANCE projection -- that represents an alternative path to the same growth rate of per capita national income as in QUADRUPLE, but giving greater weight to the service sectors -- the share of the public higher education expenditure in total public expenditure reaches 33% under 2000-I, 28% under 2000-II, and 24% under 2000-III. In each case only the 2000-III scenario projects a share for public expenditure on higher education close to or below the current level.

6.10 A question is raised as to what share for higher education expenditure is reasonable. Comparisons of financing shares for higher education in China with other countries may be helpful in answering this question. According to UNESCO, in 1980, the share of public recurrent expenditure on education devoted to higher education was as follows: in East Asia and the Pacific, 18.5%; in Latin America, 23.5%; in West Africa, 22.6%; in East Africa, 21.5%; and among industrial market economies, 19.1%. The level was lowest in East Asia, followed by the industrialized countries. In South Korea, the share is about 16%; in Japan about 18%. Data are not available on the corresponding shares for capital expenditure, but public capital expenditure on education rarely exceeds 8 to 10% of public recurrent expenditure and the inclusion of capital expenditure would not alter the general picture. Public expenditure

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[34] See China: Long-Term issues and Options, Annex A Issues and Prospects in Education, op. cit., p. 47.

Table 6.1: ESTIMATES OF PUBLIC EXPENDITURE ON HIGHER EDUCATION BY THE YEAR 2000
(Y million at 1983 prices)

	1983 Total public costs	2000-I /a	2000-II /b	2000-III /c
Public Recurrent Expenditure on Higher Education				
Regular Higher Education				
Conventional universities	2,374	12,128	10,296	8,728
Polytechnics	20	3,032	2,574	2,188
Subtotal	2,394	15,160	12,870	10,916
Adult Higher Education				
Television universities	75	738	849	849
Workers colleges /d	-	-	-	-
Correspondence, special and evening programs	104	757	608	304
Other	160	284	228	114
Subtotal	339	1,779	1,685	1,267
Total Public Recurrent Expenditure on Higher Education	2,733	16,939	14,555	12,183
Public Capital Expenditure on Higher Education				
Equipment	51	255	205	205
Construction	256	1,276	1,022	1,022
Subtotal	307	1,531	1,227	1,227
Total Public Expenditure on Higher Education	3,040	18,470	15,782	13,410
% GNP in public expenditure on higher education	0.6			
QUADRUPLE		1.1	0.9	0.8
MODERATE		1.3	1.1	1.0
BALANCE		1.1	0.9	0.8
% of higher education in total public education expenditure	25			
QUADRUPLE		33	27	23
MODERATE		49	42	35
BALANCE		33	28	24

/a 2000-I: Estimate assumes growth in salaries of 2.29, as described below, but no further change in the education cost structure.

/b 2000-II: Estimate also assumes growth in salaries and related costs of 2.29; improvements in internal efficiency in academic programs, in particular a doubling of student: teacher ratios; a further increase of faculty salaries by 50% relative to other salaries to compensate for heavier workloads; and a 20% reduction in unit capital costs by means of adjustment in design standards and improved utilization.

/c 2000-III: Estimate includes increase in personnel costs and improvement in student: teacher ratio and reduction in unit capital costs as in 2000-II. It also includes 30% of students in conventional universities classified as nonresidential and 50% of correspondence, special and evening students fully sponsored by work units. Tuition fees in conventional universities reach 10% of unit recurrent cost; in polytechnics they reach 20%.

/d Workers colleges are, in general, not publicly financed.

Note: Estimates assume that GDP per capita rises from about $330 in 1983 to about $800 in 2000. Salaries and related personnel costs are assumed to increase in line with GDP per capita growth (i.e., 2.29 times).

on higher education as a share of total public expenditure on education does not generally exceed 25%.

6.11 Another gauge of public finance of education is the share of public educational expenditure in GNP. UNESCO data provide the following levels for about 1980: in East Asia and the Pacific, about 4.0%; in Latin America, 5.0%; in West Africa, about 4.4; in East Africa, 4.5%; in industrial market economies, 6.0%; in South Korea, 4.3%; in Japan, 6.0%. In China the level for 1983 was 2.2%. The World Bank model projects levels of between 3.0% to 3.4% in 2000 in the three scenarios of economic growth. These levels represent increases of 36% and 64% respectively in the share of public educational expenditure in GNP. Although these projected increments in public expenditure on education are already substantial, to the extent that comparative data for other countries are relevant for China, somewhat higher shares for public educational expenditure may still be possible. In the absence of such additional increases, adjustments in cost-sharing and improvements in efficiency, however, the share of public resources for education devoted to higher education tends to increase well beyond the current level by 2000. In cases of low economic growth and no gains in efficiency or in cost-sharing, it increases to levels that are much higher than those experienced by other countries.

6.12 It is worth noting -- see Table 6.2 -- that the strain on public resources available for education that would result in the scenarios cited above occurs despite a decline in the unit cost of conventional universities as a share of GNP per capita. There is, of course, generally an inverse relation between unit costs (relative to GNP per capita) and per capita income. In 1983, the recurrent unit cost of conventional universities was 2.2 times GNP per capita. (The average for East Asia and the Pacific is about 1.0. It is much closer to 0.5 in the western industrialized countries.) Under assumptions that GVIAO will quadruple in China by the year 2000, this ratio would fall to 1.4 under 2000-I, 1.2 under 2000-II, and 1.0 under 2000-III, the regional average.

6.13 The projections presented here have not considered in detail the financial impact of the low (10% enrollment rate) and high (15% enrollment rate) scenarios for enrollment growth. The implications of these alternative plans are, however, relatively clear by reference to the medium growth plan. The high growth plan would require an increase of about 25% in public expenditure on higher education in 2000 above the level projected for the medium plan. This level would be quite simply beyond the financing capacity of

Table 6.2: UNIT RECURRENT COST OF HIGHER EDUCATION IN CONVENTIONAL UNIVERSITIES AS A SHARE OF GNP PER CAPITA
(US$ at 1983 prices)

	1983 China	1980 OECD countries	2000-I	2000-II	2000-III
Unit recurrent costs	715		1,083	919	780
Recurrent unit cost as a % of GNP per capita	216	50	135	115	98

Government under any one of the three projections of the multisector model or packages of reform in internal efficiency or cost-sharing. In contrast, the low scenario for enrollment growth would require about 20% less public resources than the medium plan. If implemented in tandem with reforms of the type envisioned in 2000-II and 2000-III, the overall share of public resources for education devoted to higher education would reverse the trend since 1979 of a rising share of public educational resources devoted to higher education. Low growth of higher education -- that is to an enrollment ratio of 10% by 2000 -- accompanied by major reform in internal efficiency and cost-sharing in higher education, as under 2000-II and 2000-III, would leave the greatest volume of net resources for planned improvements in other areas of education.

6.14 There are strong reasons, however, for pursuing the medium growth scenario for higher education, along with plans to quadruple GVIAO by the year 2000. At that level of participation in higher education, the requirements for high-level manpower could be broadly satisfied. Likewise, at that level of participation, China would approach the educational standards of the upper quartile of developing countries. It would also be in a strong position for emergence as a modern industrial state in the next century. There are, however, other pressing claims on public resources for education. Some of these priorities, such as nine-year compulsory education and a significant increase in the share of secondary students in vocational and technical programs, will themselves require substantial increases in levels of public expenditure. It is unlikely that goals for these other educational programs would be achieved if public spending on higher education takes a share which significantly surpasses historical levels for China or levels allocated to higher education in other countries. Accordingly, this report suggests that there is, in effect, a tradeoff between the medium plan for expansion of higher education and other desirable educational goals. The analysis of the medium enrollment plan signals clearly the need for improvements in internal efficiency and of greater cost-sharing in higher education if this plan is to be financially feasible. In the absence of firm measures in these two areas, enrollment growth would have to be curtailed.

CHINA

ADULT HIGHER EDUCATION

1. This section contains background information on the several types of adult higher education in China. These are the system of TV universities; workers universities; and correspondence, special and evening programs mostly operated by regular universities.

2. TV Universities. The TV university system was started in the early 1960s to train science teachers but was closed during the Cultural Revolution. It resumed broadcasting in 1979 with the establishment of a Central Radio and Television University (CRTVU) and 28 provincial television universities (PTVUs). The CRTVU is managed under the SEdC in cooperation with the Ministry of Broadcasting. The PTVUs are administered and funded by provincial governments and local enterprises. They operate about 500 branch schools, study centers and work stations and about 14,000 TV classes in factories and various work units.

3. The CRTVU broadcasts about 33 hours of educational programs a week through the national television network. It also distributes audio cassettes and booklets to the TV classes and organizes examinations. The CRTVU provides a unified curriculum of 28 courses in science and technology and two courses in social sciences and arts. A few PTVUs offer additional courses of their own. The television lectures are supplemented by face-to-face tutoring at work stations, for which instructors are recruited from factories and nearby higher education institutions. Laboratory work is done at the branch schools and work stations, or if facilities are not available, at laboratories in other colleges and universities.

4. The Government has assigned priority to the development of the TV university system because it can achieve economies of scale and increase enrollments quickly in fields where the need for graduates become urgent. In 1983 registered enrollment was about 500,000 students. More than 90% of the students are employees of factories and other government units who have passed a TV university entrance examination. Most full-time TVU students, about 50%, are released from work either full or part time to attend classes. Many of these are recent secondary graduates who have taken the entrance examination for admission to conventional universities and colleges and scored just below the cut-off point. In addition, an estimated 5-6 million free viewers (unregistered students) watch such programs as TV English language.

5. Recent assessments of the TV university system in China have identified several areas for improvements.[1] These include: strengthening the technical capacity of production personnel in order to raise the quality of programming; provision of additional facilities and equipment for production, as well as for branch schools and study centers; and finally, an extension of transmission capability, most likely via the use of satellite technology for wider coverage in urban areas and, ultimately, expansion into rural areas.

6. Workers Universities. Reconstruction of workers' education began toward the end of the Cultural Revolution with a view to accelerating the production of high-level manpower by means of employee in-service study. Under the general guidelines for workers' education, workers are guaranteed at least four hours for spare-time study per week. With approval from their work units, they may engage in full-time study. The Government announced in 1981 that 1.5% of the total wage bill of workers and staff should be used for education. Many large-scale enterprises and technical bodies under state ministries desired to use these resources for university-level courses to be conducted under their own auspices. By the end of 1983, China had established over 800 workers colleges with enrollment of about 170,000 students. In addition to workers universities operated directly by enterprises, mass organizations, some provincial and municipal bureaus of education as well as certain formal universities offer programs directly tailored to the urban adult worker. Enrollment varies from institutions with less than 200 students to enrollments as large as 5,000. In order to exercise greater control over quality of these programs -- that deteriorated during the mid-1960s to late 1970s -- entry to courses is increasingly selective. Employees attending full degree programs are further required to have senior middle school graduation or equivalent, two years work experience, and in most cases have passed entrance examinations at the provincial level.

7. There is no standard course structure for these programs and there are vast differences in the content, quality and intensity of programs organized by different units. Students are generally required to devote a substantial portion of time to basic theory; project assignments are designed in reference to a student's responsibilities and requirements at the work place; external monitoring of courses of study and student achievement is encouraged by state education officers for purposes of quality control. Since most workers colleges are run directly by factories, mines, enterprises or trade unions in each locality, the chief purpose is to raise the economic performance of the worker's employing unit. Hence, the specializations offered are geared closely to requirements of the work place. Graduates return to their assigned jobs following training.

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[1] Hawkridge, O. and McCormick, B., "China's Television Universities," British Journal of Educational Technology No. 3 Vol 14 October 1983, pp. 160-173; Wang Y., "China's Radio and Television Universities," Prospects, Vol XIV, No. 1, 1984, pp. 151-157; Radio and Television Universities in China, CRTVU Beijing, 1984; World Bank Project Working Paper, China Television Universities and Polytechnic Project, 1983.

8. In the reformed economic environment under which enterprises will now operate, there may well be a decline in enterprise commitment to training. These reforms extend the decision-making power of enterprises in all areas of human resource management. Reforms in these areas are directed at allowing enterprises more authority in hiring, promotion and termination of workers and in linking pay to performance, responsibility and productivity. A possible increase in labor mobility, combined with expanded autonomy in the utilization and compensation of workers by enterprises, is expected to improve efficiency and raise productivity. In the new environment created for these reforms, managers of enterprises will be more cost and profit conscious. They will also recognize that developing knowledge and skills of workers, while an investment, is also a charge on operating costs. And greater competition in the future among enterprises for skilled labor and increased worker mobility may increase the risk to the enterprise of trained personnel moving to other employment.

9. Correspondence, Special and Evening Programs. Correspondence, special and evening education has expanded as rapidly as formal higher education since 1979 and is surpassed in rate of growth only by enrollment in the TV university system. Correspondence education is recognized for degree purposes and is an acknowledged method of providing cost-effective education. Its direct recurrent costs are perhaps 10-15% the cost of conventional higher education. In 1983, some 298,000 correspondence students were undertaking studies at regular academic institutions. These have recruited a few full-time teachers for this purpose, but their services are supplemented by internal university staff and part-time staff at off-campus correspondence stations. The academic content of correspondence courses varies according to the specialty of each providing university. Course length is from three to five years. Successful students will have devoted 4,000-5,000 hours to their studies before attempting final examinations. This is a heavy study load (about 15 hours a week) and student dropout and failure rates are high. It is not unreasonable to assume that only about 50-60% of correspondence students successfully complete their programs of study.

10. In large urban areas, universities are also increasingly engaged in offering special (short-term) courses and evening programs. These courses are either for students formally registered for a degree, as in the correspondence program, or students who are only seeking specialized coursework in a field in which the institution has some expertise.

11. In the degree that correspondence, special and evening programs are adjunct to regular full-time university programs, there are several advantages to this approach. By comparison with independent programs, quality control is more assured in that courses are managed by recognized academic leaders of the mainstream universities in China. Teaching personnel, educational materials, equipment and facilities can obtain as high a standard as that provided in conventional universities. Evening courses are operated in hours when university classrooms and laboratories would not be in use, thus making use of resources that in many university institutions are underutilized. Indeed, the intensification of programs of this kind is encouraged by the recent Decision on Education Reform that delegates greater autonomy to universities and encourages enrollment of students outside the unified state plan. This

provision includes enrollment of students under contract with the receiving university and at employers' request. Those units making the requests should pay a certain amount of the training fees to the school, according to the contract, and the students should fulfill contract obligations to work for the employer after graduation.

12. Probably the major potential weakness of correspondence, special and evening study is that inherent in any part-time program: the student as well as the institution may not possess sufficient commitment to this form of education, which is a secondary activity for each. A major safeguard in these circumstances is the sponsorship of the employer and the contractual obligations of each party -- the university, the student and the employer.

CHINA

COST CATEGORIES AND FUNCTIONS

1. The aim of this annex is to describe the categories of cost that are used in Chapter III. These categories draw on standard economic theory and generally conform with UNESCO guidelines for cost analysis of educational institutions.

Definition of Cost Categories

2. Total costs of providing university education can generally be classified as either fixed or variable costs. In the short-run fixed costs are defined as costs that are independent of the size of operation (the number of students). They are typically the costs of physical plant and equipment, but in the case of universities, fixed costs could also include the cost of central administration, and general support services such as libraries and computer centers. Variable costs include those factors of production that can be more easily varied including the number of teachers and their support services. Average cost (or unit cost) is defined to equal the total cost divided by the number of students served. The marginal cost gives the additional cost of providing one more unit of input, as a function of the number of units already provided. In this case this could be the additional cost of providing university education to one more student.

3. Another distinction is between recurrent cost and capital cost. Recurrent costs are those incurred for goods or services that are used up as they are bought. The principal recurrent cost in universities is the cost of teachers' time. Since teachers are paid while they provide the service, the useful lifetime of what is actually purchased simply coincides with the pay period. Items such as teaching materials and supplies that are consumed in less than an accounting period (one year) are also treated as recurrent costs. A capital cost is one that is incurred to acquire goods or services that will have a useful lifetime extending beyond the time of purchase. The line between capital and recurrent costs is usually drawn at one year. If the lifetime of an item of equipment is greater than one year, its cost is usually treated as a capital cost.1/

4. An occasional source of confusion is between fixed costs and capital costs. There can be fixed costs that are recurrent (power supply for air conditioning of a computer installation). Likewise, there may be capital costs that are variable (video display terminals for education television). Thus the concepts of fixed costs and capital costs are different, though it is often true that major capital expenditures are associated with substantial fixed costs like physical plant and equipment.

1/ Coombs, P. and Hallak, J., Managing Educational Costs, Oxford University Press, London, 1972.

Conceptual Framework

5. The analysis that follows is concerned with average recurrent costs in Chinese universities. Capital expenditures occur too infrequently to measure adequately actual yearly capital costs, and reliable data on depreciation or value of buildings and equipment at the level of each institution are simply not available.2/ When capital inputs are not included, the estimated average cost functions can still be useful for evaluation of efficiency in the use of other inputs, labor, consumable materials, supplies, etc.3/

6. The general methodology for investigating scale economies is well established.4/ It consists of estimating average cost curves of the type:

$$AVC = F(S, X_1, X_2 \ldots X_n; \bar{Q}, p_1, p_2 \ldots p_m) \ldots (1)$$

where AVC is the average cost, S denotes the size of the educational institution under consideration, X_1, X_2 ... X_n stand for exogenous factors that may account for differences among the units under study, $\bar{Q}$ represents the quality of educational output, and p_1, p_2 ... p_m are the prices of education inputs.

7. Several comments are required on the estimation of equation 1. First, if the data under consideration are a cross-section, no explicit consideration need be given to the price variables. The unit prices of labor

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2/ While the value of total recurrent costs can be easily obtained from higher education budgets and reports of actual expenditures, the value of capital facilities does not appear so easily. Indeed, annual capital outlays will tend to fluctuate widely over time and, in any case, are not a valid proxy for annualized capital costs. When capital costs are taken into account, greater variation in per student costs among institutions of different kind (agriculture, engineering, medica, etc.) and of different size (enrollments) may be expected.

3/ However, failure to include capital in the regression equation may cause a specification error in the estimated equation, resulting in two problems. First, the regression coefficients on any variables correlated with capital inputs may be biased. Second, the error variances may be biased upwards, causing the test for significant size economies to be too strict. The practice in Chinese universities is to allocate space and equipment on a per student basis using fixed coefficients. This policy would tend to dampen in practice any effects of scale economies in capital expenditure. In this sense the absence of capital costs in our average cost functions should not introduce significant bias in the regression coefficients.

4/ See Kumar, R., "Economies of Scale in School Operation: Evidence from Canada," Applied Economics, Vol. 15, 1983, pp. 323-340; and Watt, T., "The Effect of School and District Size on Education Costs in British Columbia," International Economic Review, Vol. 14, No. 3, 1973, pp. 710-720.

and other inputs in China do not differ substantially by location of institution. We are thus reasonably safe in disregarding price differentials. A second, and perhaps more important question, relates to the definition and measurement of quality of education. Typically, quality per pupil depends upon exogenous factors, such as student characteristics, as well as university inputs. Thus individual background characteristics of students should, in theory, be controlled in a study of the relationship between costs to universities and their outputs. When only data on university expenditure and size are available, however, it is not possible to control for individual differences in students. A commonly accepted alternative is to introduce into the AVC function variables that are seen a priori to affect the quality of endogenous factors.5/ Examples are the student teacher ratio or the proportion of qualified teachers (as measured against some common standard).

8. Third, the selection of functional forms for estimating AVC is not self-evident. Applications of economics to production and costs have shown that, under certain conditions, for any particular production function there exists a unique cost function and vice versa. Therefore the supply aspects of a system can be modeled either in terms of production or cost. At the same time, a large family of positive, homogenous, non-decreasing, concave functions of input prices can be classified as cost functions, so the choice of functional form is quite arbitrary. Empirical studies of economies of scale in education have generally adopted a parabolic or quadratic function.6/ This approach implicitly accepts the existence of an "optimal" point, in terms of enrollment, beyond which diseconomies set in. A hyperbolic function has also been estimated and is considered more appropriate where discontinuities exist in one or more factor inputs. This approach maintains that limits imposed on some factors, such as student teacher ratio, would ensure that there are no diseconomies of scale. In this case an "optimal" university size is never attained, as costs continue to decrease when university size is increased. We present below these two basic models in simplified form:

(1) The quadratic form is

$$AVC = a_o + a_1(ENT) + a_2(ENT)^2 + a_3(STR) + \ldots$$

(2) The hyperbolic form is

$$AVC = b_o + b_1(ENT)^{-1} + b_2(STR) + \ldots$$

where ENT denotes "enrollment" and STR denotes "student teacher ratio".

5/ Kumar, op. cit.

6/ Riew, J., "Economies of Scale and High School Operation," The Review of Economics and Statistics, No. 48, pp. 280-287; Cohn, E., "Economies of Scale in High School Operations," Journal of Human Resources, Vol. 3, No. 4, pp. 422-434; Fox, W., "Reviewing Economies of Size in Education," Journal of Education Finance, Vol. 6, No. 4, pp. 273-296; and Bowen H., "Observations on the Costs of Higher Education," Quarterly Review of Economics and Business, Vol. 21, No. 1, pp. 47-57.

Table B.1: CHINA: LIST OF ALL VARIABLES

Variable names	Description
AVC1	Average recurrent cost per undergraduate student
AVC2	Average recurrent cost per student including both undergraduates and graduates
AVC3	Average recurrent cost per student including undergraduate, graduate and special students
ENT1	Total undergraduate enrollment
ENT2	Total enrollment including undergraduate and graduate students
ENT3	Total enrollment including undergraduate, graduate and special students
ENT1SQ	The square of ENT1
ENT1INV	The inverse of ENT1
ENT2SQ	The square of ENT2
ENT2INV	The inverse of ENT2
ENT3SQ	The square of ENT3
ENT3INV	The inverse of ENT3
STR1	Student teacher ratio using ENT1 as the number of students in the ratio
STR2	Student teacher ratio using ENT2 as the number of students in the ratio
STR3	Student teacher ratio using ENT3 as the number of students in the ratio
NTS	Number of teaching staff
NNTS	Number of nonteaching staff
TS	Total staff
TSSR1	Total student staff ratio using ENT1
STSR1	Student teaching staff ratio using ENT1
SNTSR1	Student nonteaching staff ratio using ENT1
TSSR2	Total student staff ratio using ENT2
STSR2	Student teaching staff ratio using ENT2
SNTSR2	Student nonteaching staff ratio using ENT2
TSSR3	Total student staff ratio using ENT3
STSR3	Student teaching staff ratio using ENT3
SNTSR3	Student teaching staff ratio using ENT3
TQ	Proportion of teachers without a university degree
NSPEC1	Number of specializations (degree areas) at the undergraduate level
NSPEC2	Number of specializations at undergraduate and graduate level
NSPEC3	Number of specializations at undergraduate and graduate level and special programs
SA1	Salaries for administrative staff
SUB1	Subsidies for administrative staff
BEN1	Benefits for administrative staff
SA2	Salaries for teachers
SUB2	Subsidies for teachers

Table B.1: (cont'd)

Variable names	Description
BEN2	Benefits for teachers
SA3	Salaries for support staff
SUB3	Subsidies for support staff
BEN3	Benefits for support staff
SAL	Total salaries
SUBT	Total benefits
BENT	Total subsidies
CONM	Expenditure on consumable materials in classrooms, laboratories, workshops
BKS	Expenditure on books and other reading materials
OTS	Expenditure on other consumable materials related to teaching
CONMS	Expenditure on consumable materials and supplies for student boarding
TRSP	Expenditure on transportation
MB	Expenditure on maintenance of buildings, facilities and equipment
ADE /a	Total expenditure on salaries, subsidies and benefits for administrators
TEE	Total expenditure on salaries, subsidies and benefits for teachers
OTE	Total expenditure on salaries, subsidies and benefits for support staff
PRE	Total expenditure on personnel
IRE	Total instructional-related expenditure not related to personnel
NIRE	Total noninstructional-related expenditure
PTS	Payments directly to students
PADE	Proportion of total recurrent expenditure on ADE
PTEE	Proportion of total recurrent expenditure on TEE
POTE	Proportion of total recurrent expenditure on OTE
PPRE	Proportion of total recurrent expenditure on PRE
PIRE	Proportion of total recurrent expenditure on IRE
PNIRE	Proportion of total recurrent expenditure on NIRE
PCONMS	Proportion of total recurrent expenditure on CONMS
PPTS	Proportion of total recurrent expenditure on PTS
UTL	Expenditure on public utilities, electricity, telephone, water, etc.
TRE	Total recurrent expenditure.
NKIND1	Dummy variable for agriculture and related universities
NKIND2	Dummy variable for science and technology universities
NKIND3	Dummy variable for universities of economics, finance, law or political science
NKIND4	Dummy variable for comprehensive universities
NKIND5	Dummy variable for normal universities

/a Note that subscripts in the tables on ADE, TEE, OTE, PRE, IRE, NIRE, CONMS indicate average value as determined by dividing by ENT1, ENT2 or ENT3.

DATA SET = ALL QUESTIONNAIRES
Number of Observations = 66

Table B.2: CHINA: BASIC STATISTICS OF VARIABLES: QUESTIONNAIRES

Variables	Mean	Standard deviation	Minimum value	Maximum value
AVC1 /a	1.860	0.690	0.800	4.300
AVC2 /a	1.790	0.620	0.799	3.600
AVC3 /a	1.320	0.540	0.386	3.100
ENT1	3,134.5	1,157.9	1,089	6,164
ENT2	3,243.9	1,207.8	1,147	6,481
ENT3	4,755.6	2,357.8	1,306	10,883
STR1	3.77	1.10	1.64	6.90
STR2	3.87	1.06	1.72	7.00
STR3	5.61	2.39	2.18	15.2
TQ	0.16	0.07	0.01	0.30
NSPEC1	14.69	8.51	2	42
NSPEC2	29.15	14.65	8	84
NSPEC3	38.72	16.98	10	94
SA1	366.55	152.51	105.40	875.0
SUB1	56.77	47.02	1.90	452.4
BEN1	33.02	43.03	5.10	350.5
SA2	934.01	436.14	73.00	2,178.00
SUB2	127.14	62.99	4.30	379.00
BEN2	69.80	43.66	11.70	263.00
SA3	346.69	315.72	53.20	2,160.10
SUB3	61.16	51.38	1.80	311.8
BEN3	29.91	27.22	4.20	194.0
SAL	1,647.26	729.27	584.00	3,618.00
SUBT	245.07	133.42	8.00	721.9
BENT	132.73	92.63	21.50	547.0
CONM	833.81	616.52	170.00	2,847.00
BKS	302.70	174.07	17.00	1,073.00
OTS	378.82	467.50	8.40	2,400.00
CONMS	428.84	432.73	35.00	2,466.00
TRSP	197.76	440.84	9.70	3,061.00
MB	708.15	489.20	9.50	2,396.00
UTL /b	394.24	507.09	75.00	2,861.10
ADE	456.34	193.85	127.90	1,062.00
TEE	1,130.96	504.65	195.60	2,591.00
OTE	437.76	352.03	80.30	2,228.50
PRE	2,025.06	860.43	763.60	4,718.00
IRE	1,515.32	864.93	390.00	4,024.00
NIRE	1,334.74	860.61	291.20	5,003.00
PTS	666.76	289.71	169.50	1,477.00

/a Measured in Y'000.
/b N = 28.

DATA SET = POOLED SAMPLE FROM APPRAISAL REPORTS,
ANNUAL REPORTS AND QUESTIONNAIRES
Number of Observations = 136

Table B.3: CHINA: BASIC STATISTICS OF VARIABLES: POOLED SAMPLE

Variables	Mean	Standard deviation	Minimum value	Maximum value
AVC1 /a	1.470	0.660	0.485	4.100
AVC2 /a	1.430	0.630	0.471	4.100
AVC3 /a	1.260	0.690	0.221	4.100
ENT1	2,524.24	1,192.04	499	6,164
ENT2	2,591.65	1,248.56	499	6,481
ENT3	3,381.15	2,268.34	499	10,883
STR1	3.67	2.31	1.33	26.40
STR2	3.74	2.30	1.46	26.40
STR3	4.73	2.94	1.46	26.40
TQ	0.170	0.130	0.000	1.000
NSPEC1	10.760	7.440	2	42
NSPEC2	17.850	14.810	3	84
NSPEC3	22.530	19.290	3	94

/a Measured in Y'000.

教育机构经常性开支分析

ANALYSIS OF RECURRENT EXPENDITURE IN EDUCATIONAL INSTITUTIONS

学校名称 Name of Institution: ____________

地址 (省、市) Location (Province Municipality ____________

Academic Year Covered by Information (学年) ____________

教育类别 (中等、大学) Type of Education (secondary, university) ____________

财政年

1. Fiscal year __________

2. Personnel-related expenditure
人员开支

	Expenditure 费用(支出)				Budget 予算
行政人员	Salaries 工资	Subsidies 补贴	Benefits 福利	Total 总计	
2.1 Admin Staff 执行人员 2.2 Teaching staff 工勤人员 2.3 Caretakers kitchen staff, drivers, etc					
Total 总计					

3. Recurrent expenditure directly related to instruction.
与教学直接相关之经常性开支

	Expenditure 开支	Budget 预算
消费性材料 3.1 Consumable materials in classrooms, 教室、 laboratories, 实验室、 workshops 车间		
3.2 Books and other reading materials 书及其他阅读材料		
3.3 Other consumables 其它消费性开支		
Total 总计		

4. Recurrent expenditure not directly related to construction.
与教学无直接关系之经常性开支

	Expenditure 开支	Budget 预算
膳宿消耗材料和提供给住宿生[illegible] 4.1 Consumable materials and supplies for student boarding		
交通 4.2 Transportation		
校舍和设备维修 4.3 Maintenance of building and facilities		
公用设施费（包括水费. 4.4 Public utilities 电费.煤气费.等）		
Total 总计		

5. Payment to students 学生款项

	Expenditure 开支	Budget 预算
学生补助 5.1 Student subsidies		
Total 总计		

各系、各专业本科生

6. UNDERGRADUATE STUDENTS BY DEPARTMENTS AND SPECIALIZATION

Institution:
院校

Department/ 系/专业 Specialization	Total Number of 本科生总数 Undergraduate Students
总计 Total	

各系各专业研究生数

7. POSTGRADUATE STUDENTS BY DEPARTMENT AND SPECIALIZATION

名称
Institution:

A. Is the institution authorized to grant postgraduate degrees in any specialization? 本系是授权在一些专业授予研究生学位吗？

Master's degree: 硕士学位 ：
Doctoral degree: 博士学位 ：

B. Does the institution presently have students enrolled in postgraduate degree programs? 目前是否有研究生攻读学位？

Master's degree: 硕士学位，
Doctoral degree: 博士学位：

C. If there are "yes" answers to A and/or B, please specify the following information:
如果是肯定答复，请具体说明：

Department/Specialization (list) 系 / 专业	Total number of post-graduate students 研究生总数
Total	

本系中业余和专修学生

8. PART-TIME AND SPECIAL STUDENTS BY DEPARTMENT AND SPECIALIZATION

Institution:
名称

Department/Specialization/ Special Program 系/专业/某一特别计划	Total number of part-time and special students 业余学生和专修学生总数
Total 总计	

教学人员受大学教育年数及年令

9. TEACHING FACULTY BY YEARS OF POSTSECONDARY EDUCATION AND AGE

Institution:
单位名称：

Years of post-secondary education 大学教育年数	Age 年令				
	Under 30 30岁以下	30–45 30-45岁	45–60 45-60	Over 60 60以上	Total 总计
Less than 4 少于四年					
4–5 4-5年					
5–6 5-6年					
Over 6 6年多					

CHINA

ESTIMATION PROCEDURES FOR AVERAGE RECURRENT COST FUNCTIONS

1. The data for this analysis are taken from several sources. They include universities assisted under World Bank loan projects in China. These are: University Development Project I (Loan 2021, Credit 1167) covering 26 key universities in science and engineering fields; Agricultural Education and Research Project I (Credit 1297) encompassing 11 colleges of agriculture or related fields; Agriculture Education Project II (Loan 2444, Credit 1500) with 12 additional colleges of agriculture or related fields; Rural Health and Medical Education Project (Credit 1472) financing 13 medical colleges; and data on institutions surveyed by the appraisal mission for the proposed provincial university development project.[1]

2. Given this variety of sources and difference in level of detail, the data were analyzed in two separate data files. The largest file, a pooled sample, contains information collected by appraisal missions and in World Bank reports, working papers and questionnaires. It contains in total 136 observations. A second file of 77 institutions surveyed by means of a detailed Bank questionnaire was also analyzed separately. This is included in Annex C. This questionnaire was prepared by Bank staff to obtain a picture of the structure of operating costs in a variety of expenditure categories as well as detailed information on academic programs, teaching faculty and student characteristics. In each case a few institutions were removed from the files because of missing data or errors in completing survey material, including the detailed questionnaire. Accordingly, the number of institutions included in the cross-sectional analysis for each of the two files was slightly below the number originally included.

3. Variables. In the estimations of average recurrent cost functions alternative calculations of average recurrent cost per student were used (AVC1, defined as the total recurrent expenditure divided by ENT1, the number of undergraduate students; AVC2, total recurrent expenditure divided by ENT2, the number of undergraduate and graduate students; and AVC3, total recurrent expenditure divided by ENT3, the number of undergraduate, graduate and special students).[2] These three calculations of AVC were used because there was no

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[1] The degree of detail and, to some extent, the quality of the data vary by source of information. For those institutions assisted under ongoing projects, information on enrollments, characteristics of the institutions, and their budgets was collected according to differing formats by the appraisal missions. This material has been updated (in all cases but the health project) by annual reports submitted by project units. In all, these data cover academic year 1981-82 or, in a few cases, 1982-83.

[2] Table B.1 in Annex B provides a detailed description of the cost categories considered for the data set of questionnaires as well as the explanatory variables, including their names (computer labels).

way to portion out costs among these three types of students on the basis of available breakdowns of expenditures. Nor is there any compelling reason *a priori* to assign different weights in computing average costs to students at the undergraduate or graduate level or to special students. Both undergraduate and graduate students are in full-time attendance. Although not formally registered for a degree, special students are for the most part also in full-time attendance. Since total recurrent expenditure was expended on all three types of students, we shall emphasize AVC3 in the analysis.

4. For each measure of average recurrent cost (the dependent variable), five estimations of average recurrent cost functions were made: a linear estimation of enrollment on average recurrent cost; a quadratic estimation; a quadratic estimation with student teacher ratio also entered; a hyperbolic estimation; and, finally, a hyperbolic estimation with student teacher ratio also entered. For the data set of questionnaires, these five estimations were also made for different categories of recurrent expenditure. This procedure yields a reasonably detailed picture of university costs -- including personnel costs, instructional costs (not including personnel) and non-instructional costs -- as a function of size and certain operating characteristics of the institutions (like student teacher ratio).

5. In addition to the size variables, measured by enrollment (either ENT1, ENT2 or ENT3), there are two other classes of explanatory variables. First, two variables were used as approximate indicators of quality: the student teacher ratio (STR1, STR2, STR3); and teacher quality (TQ, the proportion of teachers without a university degree, the minimum qualification for teaching at the university level). Second, the estimations also used (0,1) dummy variables to differentiate among different kinds of institutions. Five (0,1) dummy variables were used for the following six kinds of institutions: NKIND1 for universities of agriculture, forestry, fisheries, meteorology and hydrology; NKIND2 for universities of science or engineering; NKIND3 for universities (or institutes) of economics, finance, law or political science; NKIND4 for comprehensive universities; and NKIND5 for normal universities. An "0" on each of these variables identifies the set of medical colleges. (This procedure accounts for differences in the intercept terms between the different kinds of institutions.) Clearly the variables on student teacher ratio and on teacher quality belong to the category of $\bar{Q}$ in equation 1 (Annex B), while the remaining variables represent X_i, exogenous factors.

6. The greatest weakness in the quality of the data is found in the classification of expenditure. In a classification used by SEdC, World Bank appraisal missions and in project reports, expenditures are recorded by salaries, subsidies and other staff benefits, consumable instructional material, utilities, equipment, building maintenance and miscellaneous. The category of miscellaneous was generally very small or zero. Although it was relatively stable over two or three years in some cases, the category of equipment was dropped from the analysis as it seemed by definition to correspond more with capital expenditure. Building maintenance was included, even though it was large enough in certain cases to suggest possible expenditure on remodelling or modest expansion of existing facilities. The category of utilities, which was understood in the large file to refer to expenditure on consumption of electricity, water, and telephone, averaged less than 8% of

estimated total recurrent expenditure in the large file. Despite doubts as to its definition and accuracy in many cases, it was included under total recurrent expenditure whenever it was reported, as the items under utilities undoubtedly appeared in university accounts.

7. A second problem with respect to expenditure data occurred in the 77 institutions that completed the detailed questionnaire. Expenditure on utilities was not specified carefully enough in the questionnaire (and in some cases was mistranslated). This resulted in missing data in about one third of all cases, an obvious error in 27 cases and presumably accurate reporting in 29 others. In the cases where the item was properly reported, utilities as defined in the questionnaire constituted, on average, about 5% of total recurrent expenditures. However, it seemed to follow no observable pattern with respect to type of institution, size of enrollment, or other categories of expenditure. Given the large number of missing cases and the difficulty of making any adjustments or reasonable estimates due to the variations in observed cases, we choose to disregard utilities in analysis of the questionnaire. On the basis of the estimated share of 5% of total recurrent expenditure on utilities, this would tend to lower average unit recurrent expenditure by about 5% in the data file based on the Bank's questionnaire.

8. Despite these limitations, the data files, while not ideal, are detailed enough to allow us to carry out quite thorough analysis of recurrent costs. One further caveat is however required. The universities in each file are not a representative sample. They have entered the data sets because in one way or another they have been or will be assisted under Bank projects. In aggregate these institutions cover various kinds of universities (agriculture and related fields; science and technology; law, finance and management; comprehensive; normal; and medical colleges). They are also affiliated with a large class of agencies, SEdC, technical ministries or provinces. Information on both the kind of each institution and its affiliation is entered into each data file and has been used in the analysis. Even so, the generalizability of the results should be interpreted with care.

9. Tables D.1 to D.2 display the main results of the estimation exercise. An examination of these tables for AVC1, AVC2 and AVC3, as dependent variables in all three data sets, indicates reasonably good estimations. In all cases the F-statistic, establishing the statistical significance of the estimation, is significant at the 1% level. $\bar{R}^2$, a measure of the proportion of total variance in the dependent variable (adjusted for degrees of freedom) that is accounted for (or "explained") by the estimated functions, is in general reasonably large.

10. The coefficients for the explanatory variables generally have the expected sign and always have the expected sign when they are significant at the 5% level or better. However, the goodness of fit is by no means uniform across the three data sets or, of course, for different forms of the functions. The goodness of fit is typically better for average recurrent cost estimated by AVC3 (that is, total recurrent expenditure divided by total number of students) than for AVC2 (where the denominator includes both undergraduate and graduate students) or AVC1 (where the denominator includes only undergraduates). As for functional form, for the pooled sample, equation 5 in

Table D.1, the hyperbolic form, including student teacher ratio and dummy variables for kind of institution, gives the best fit for AVC1, AVC2, and AVC3, with $\bar{R}^2$ between 0.42 and 0.61 and coefficients of all variables significant (generally at the 1% level). This same pattern holds broadly for the estimations of AVC1, AVC2 and AVC3 based on the data set of questionnaires, Table D.2 with $\bar{R}^2$ between 0.49 and 0.54.

11. With respect to the explanatory variables, several comments are in order. The variable TQ (teacher quality as measured by the proportion of unqualified teachers in each institution) was dropped from the analysis. This variable holds no observable relation to average cost or other characteristics of the institution. Although the variable is well-defined, pay scales, promotional possibilities, course-load, or other operating characteristics related to the use of the teaching force, have not been closely tied in Chinese universities to the basic qualification of the individual teacher. Equally important, average student teacher ratios are very low -- in the range of 2.0 to 3.5, never above 7.0. This suggests an inefficient use of teachers that would further tend to mask any quality effect due to a higher proportion of qualified faculty members. In contrast the various measures of student teacher ratio were retained in the analysis as they proved quite powerful in virtually all functional forms.

DATA SET = ALL QUESTIONNAIRES
Number of observations = 66

CHINA: ESTIMATED AVERAGE COST CURVES: QUESTIONNAIRE

Dependent variables	Explanatory variables						
	Constant	ENT1	ENT1SQ	ENT1INV	STR1	$\bar{R}^2$	F
1. AVC1	2.5649 (11.2)/a	$-2.2409\text{x}10^{-4}$ (3.3)/a	-	-	-	0.13	10.7/a
2. AVC1	2.7620 (5.3)/a	$-3.6213\text{x}10^{-4}$ (1.1)	$2.1134\text{x}10^{-8}$ (0.4)	-	-	0.12	5.4/a
3. AVC1	3.5291 (8.6)/a	$1.8592\text{x}10^{-5}$ (0.1)	$-1.4415\text{x}10^{-8}$ (0.4)	-	$-4.1536\text{x}10^{-1}$ (6.9)/a	0.49	22.1/a
4. AVC1	1.2832 (6.7)/a	-	-	1544.7870 (3.3)/a	-	0.13	10.8/a
5. AVC1	3.2507 (10.1)/a	-	-	458.4520 (1.2)	$-4.1427\text{x}10^{-1}$ (6.9)/a	0.49	33.1/a

(cont'd)

Dependent variables	Explanatory variables						
	Constant	ENT2	ENT2SQ	ENT2INV	STR2	$\bar{R}^2$	F
1. AVC2	2.3904 (11.6)/a	-1.8498×10^{-4} (3.1)/a	-	-	-	0.11	9.7/a
2. AVC2	2.6815 (5.8)/a	-3.8080×10^{-4} (1.3)	2.8770×10^{-8} (0.7)	-	-	0.11	5.0/a
3. AVC2	3.3873 (9.1)/a	-7.1343×10^{-6} (0.0)	-9.1278×10^{-9} (0.3)	-	-3.7808×10^{-1} (6.7)/a	0.47	20.5/a
4. AVC2	1.2662 (7.3)/a	-	-	1444.7660 (3.3)/a	-	0.13	11.1/a
5. AVC2	3.0558 (11.0)/a	-	-	494.5760 (1.3)	-3.7296×10^{-1} (6.6)/a	0.48	30.9/a

(cont'd)

Dependent variables	Explanatory variables					$\bar{R}^2$	F
	Constant	ENT3	ENT3SQ	ENT3INV	STR3		
1. AVC3	1.9605 (15.9)/a	$-1.3461\mathrm{x}10^{-4}$ (5.8)/a	-	-	-	0.33	33.6/a
2. AVC3	2.2484 (9.0)/a	$-2.6182\mathrm{x}10^{-4}$ (2.5)/a	$1.1287\mathrm{x}10^{-8}$ (1.3)	-	-	0.34	17.9/a
3. AVC3	2.4212 (11.4)/a	$-1.0484\mathrm{x}10^{-4}$ (1.2)	$4.3680\mathrm{x}10^{-9}$ (0.6)	-	$-1.2923\mathrm{x}10^{-1}$ (5.3)/a	0.53	26.3/a
4. AVC3	0.7695 (6.6)/a	-	-	2021.9370 (5.4)/a	-	0.30	29.3/a
5. AVC3	1.8407 (9.1)/a	-	-	865.0730 (2.4)/b	$-1.3478\mathrm{x}10^{-1}$ (6.0)/a	0.54	40.5/a

/a Statistically significant at 1%.
/b Statistically significant at 5%.
/c Statistically significant at 10%.

Note: Figures in parentheses are /t/ ratios.

DATA SET = POOLED SAMPLE FROM APPRAISAL REPORTS, ANNUAL REPORTS AND QUESTIONNAIRES
Number of observations = 136

CHINA: ESTIMATED AVERAGE COST CURVES: POOLED SAMPLE

Dependent variables	Explanatory variables											
	Constant	ENT1	ENT1SQ	ENT1INV	STR1	NKIND1	NKIND2	NKIND3	NKIND4	NKIND5	$\bar{R}^2$	F
1. AVC1	2.8824 (14.5)/a	-2.1904x10^{-4} (4.4)/a	-	-	-	-9.0831x10^{-1} (4.9)/a	-8.5241x10^{-1} (4.5)/a	-1.2437 (3.9)/a	-1.0409 (4.8)/a	-9.6690x10^{-1} (4.6)/a	0.34	11.5/a
2. AVC1	3.4548 (12.1)/a	-6.5514x10^{-4} (3.9)/a	7.4628x10^{-8} (2.7)/a	-	-	-9.788x10^{-1} (5.3)/a	-9.0146x10^{-1} (4.9)/a	-1.2536 (4.1)/a	-1.0515 (5.0)/a	-1.0332 (5.0)/a	0.37	11.5/a
3. AVC1	3.6502 (12.6)/a	-6.1821x10^{-4} (3.8)/a	7.0639x10^{-8} (2.6)/a	-	-5.4797x10^{-2} (2.7)/a	-1.0528 (5.8)	-9.7879x10^{-1} (5.4)/a	-1.2677 (4.2)/a	-1.1038 (5.4)/a	-1.0737 (5.3)/a	0.40	11.4/a
4. AVC1	1.9315 (11.2)/a	-	-	902.6990 (5.8)/a	-	-9.8710x10^{-1} (5.5)/a	-9.1711x10^{-1} (5.1)/a	-1.2157 (4.1)/a	-1.1133 (5.5)/a	-1.0979 (5.7)/a	0.40	14.7/a
5. AVC1	2.1999 (11.0)/a	-	-	845.6720 (5.5)/a	-5.1134x10^{-2} (2.5)/b	-1.0541 (6.0)/a	-9.8810x10^{-1} (5.6)/a	-1.2308 (4.2)/a	-1.1592 (5.9)/a	-1.1321 (6.0)/a	0.42	14.0/a

Table D.2: (cont'd)

Dependent variables	Explanatory variables											
	Constant	ENT2	ENT2SQ	ENT2INV	STR2	NKIND1	NKIND2	NKIND3	NKIND4	NKIND5	$\bar{R}^2$	F
1. AVC2	2.8044 (15.3)/a	-1.9242×10^{-4} (4.4)/a	-	-	-	-9.0831×10^{-1} (5.2)/a	-8.8334×10^{-1} (5.0)/a	-1.2518 (4.3)/a	-1.0776 (5.4)/a	-9.9538×10^{-1} (5.1)/a	0.36	12.8/a
2. AVC2	3.3878 (12.9)/a	-6.2487×10^{-4} (4.2)/a	7.0714×10^{-8} (3.1)/a	-	-	-9.7155×10^{-1} (5.7)/a	-9.2824×10^{-1} (5.4)/a	-1.2532 (4.4)/a	-1.0685 (5.5)/a	-1.0504 (5.5)/a	0.41	13.1/a
3. AVC2	3.5601 (13.5)/a	-5.9168×10^{-4} (4.1)/a	6.7028×10^{-8} (3.0)/a	-	-4.8065×10^{-2} (2.5)/b	-1.0368 (6.2)/a	-9.277×10^{-1} (5.8)/a	-1.2615 (4.5)/a	-1.1113 (5.8)/a	-1.0832 (5.8)/a	0.43	12.8/a
4. AVC2	1.9311 (12.0)/a	-	-	859.9280 (5.9)/a	-	-9.7556×10^{-1} (5.9)/a	-9.4437×10^{-1} (5.7)/a	-1.2218 (4.4)/a	-1.1354 (6.1)/a	-1.1065 (6.2)/a	0.43	16.5/a
5. AVC2	2.1678 (11.6)/a	-	-	810.3720 (5.6)/a	-4.4824×10^{-2} (2.3)/b	-1.0349 (6.2)/a	-1.0038 (6.1)/a	-1.2311 (4.5)/a	-1.1728 (6.4)/a	-1.1348 (6.4)/a	0.45	15.5/a

Table D.2: (cont'd)

Dependent variables	Explanatory variables											
	Constant	ENT3	ENT3SQ	ENT3INV	STR3	NKIND1	NKIND2	NKIND3	NKIND4	NKIND5	$\bar{R}^2$	F
1. AVC3	2.5637 (16.2)/a	$-1.1865x10^{-4}$ (4.9)/a	-	-	-	$-8.0023x10^{-1}$ (4.9)/a	$-9.7401x10^{-1}$ (5.8)/a	-1.4478 (5.1)/a	-1.8456 (6.0)/a	-1.1562 (6.0)/a	0.51	22.8/a
2. AVC3	3.0525 (15.5)/a	$-3.8769x10^{-4}$ (5.2)/a	$2.5560x10^{-8}$ (3.8)/a	-	-	$-8.9879x10^{-1}$ (5.7)/a	$-9.3730x10^{-1}$ (5.9)/a	-1.3291 (4.9)/a	-1.0909 (5.8)/a	-1.0791 (5.9)/a	0.56	23.9/a
3. AVC3	3.1928 (15.6)/a	$-3.7140x10^{-4}$ (5.1)/a	$2.5605x10^{-8}$ (3.9)/a	-	$-3.6764x10^{-2}$ (2.2)/b	$-9.5137x10^{-1}$ (6.1)/a	$-9.8506x10^{-1}$ (6.2)/a	-1.2326 (4.6)/a	-1.0808 (5.8)/a	-1.0787 (6.0)/a	0.58	22.2/a
4. AVC3	1.8015 (13.4)/a	-	-	967.6460 (7.2)/a	-	$-9.2624x10^{-1}$ (6.1)/a	-1.0179 (6.7)/a	-1.4480 (5.7)/a	-1.2790 (7.4)/a	-1.2707 (7.7)/a	0.60	31.4/a
5. AVC3	2.0246 (12.1)/a	-	-	902.4230 (6.8)/a	$-3.8615x10^{-2}$ (2.5)/b	$-9.8062x10^{-1}$ (6.5)/a	-1.0564 (7.1)/a	-1.3319 (5.2)/a	-1.2354 (7.3)/a	-1.2350 (7.6)/a	0.61	29.1/a

/a Statistically significant at 1%.

/b Statistically significant at 5%.

/c Statistically significant at 10%.

Note: Figures in parentheses are /t/ ratios.

CHINA

ANALYSIS OF SEdC SPACE STANDARDS

1. SEdC Standard and Typical North American Standard Space Requirement. For science and engineering undergraduate students, SEdC applies an average standard of 38.0 m^2 per student as a gross allowance. This includes 3.40 m^2 per student for classroom space and 8.00 m^2 per student for laboratory space. Typical standards in public universities in the United States, Canada, the United Kingdom and Australia are as follows: for arts and sciences students 1.48 m^2 per student for classroom space, and 1.35 m^2 per student in laboratory space; and for engineering students 1.18 m^2 per student in classroom space and 4.27 m^2 per student in laboratory space.1/

2. Alternative 1: Chinese average space allocation for science and engineering student based upon current average student hours per week, current levels of space utilization, and Virginia guidelines. Typical Chinese weekly student hour (WSH) standards range from 20-22 class hours per week and 6-8 laboratory hours per week. The Virginia guidelines produce 0.81 average assignable square feet (ASF) per average weekly student hour (WSH) for classrooms and 10.71 ASF per WSH for laboratories. If gross space is judged as 150% of assignable space, these work out to 2.37 m^2 per student in gross classroom space and 10.45 m^2 per student in gross laboratory space as typical Chinese requirements based on North American standards.

3. Alternative 2: Chinese average space allocation for science and engineering student based on revised average student hours per week, current levels of utilization, and Virginia guidelines. The assumptions that apply here include: (a) Chinese weekly student hour (WSH) is reduced to 18 WSH for classrooms and 5 WSH for laboratories; and (b) according to Virginia guide-

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1/ The basis for these estimates is the space planning guidelines issued by the State Council of Higher Education for Virginia. For classroom and laboratory space requirements the Virginia planning guidelines provide a guide of assignable square feet (ASF) of space per weekly student hour (WSH) for each category of space. These guides vary based upon the type and size of institution, expressed in total full time equivalent (FTE) day enrollment of the institution. The total space requirement is then estimated as the product of the appropriate guide times the average weekly student hours (WSH) for that space category times the planned full time equivalent (FTE) day enrollment. The Virginia space guides in turn are developed from consideration of three related space and space utilization factors: average assignable square feet (ASF) per student station; average room utilization rate (AvRur) in hours per week; and average station occupancy rate (AvSor) expressed as the average percent occupancy of a room. An average station utilization rate (AvSur) is calculated as the product of the room utilization and station occupancy rates (AvRur x AvSor). Division of the average station utilization rate into the average assignable square feet per student station produces the space guide.

lines the classroom allocation is 0.81 ASF/WSH; the laboratory allocation is 10.71 ASH/WSH. Thus the space requirements can be calculated as follows: for classroom space (0.81 x 18 x 1.5 ÷ 10.76) or 2.03 m^2; for laboratory space (10.71 x 5 x 1.5 ÷ 10.76) or 7.46 m^2.

4. Alternative 3: Chinese average space allocation for science and engineering student based on revised average student hours per week, improved space utilization, and Virginia guidelines. Several assumptions apply in this estimation. First, the average assignable square feet (ASF) per student station is 15 ASF per student in classroom space and 50 ASF per student in laboratory space (using Virginia standards). Second, the average room utilization rate (ARuR) is 75% level for classrooms and 50% level for laboratories (based on a 60 hour timetable of 8:00 AM to 6:00 PM Monday through Saturday). This gives 45 hours per week (7.5 hours per day) and 30 hours per week (5 hours per day) for classroom and laboratory use respectively. With average station occupancy rate (AvSoM) of 80% in each case, space guides are estimated as 0.42 ASF for classrooms and 4.17 ASF for laboratories. Average weekly student hours (WSH), utilizing average course load estimates under the credit system, remain 18 WSH and 5 WSH for classrooms and laboratories respectively. Per student gross space requirements converted to square meters are then (18 x 0.42 x 1.5 ÷ 10.76) or 1.05 m^2 per student for classroom space and (5 x 4.17 x 1.5 ÷ 10.76) or 2.91 m^2 per student for laboratory space.

5. The reduction in per student cost in expenditure on capital construction attributed to changes in classroom space and laboratory space standards as in Alternative 3 can be estimated. The difference between the current standard per student for classroom space, 3.40 m^2 and this revised figure, 1.05 m^2, is 2.35 m^2, at Y 280 per m^2, or Y 658 per student. The corresponding savings in laboratory space is the current standard, 8.00 per m^2 less 2.91, or 5.09 per m^2 per student, at Y 320 per m^2, or Y 1,629 per student. This total reduction of Y 2,287 out of an average per student cost of Y 11,537 is a savings of about 20%.

CLASSROOM UTILIZATION

Institution: Comprehensive University
Total Classrooms: 92 academic classrooms

Time Period	Classrooms in Use							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
07:30-08:20	92	92	92	92	92	92	*	552
08:30-09:20	92	92	93	92	92	92	*	552
09:40-10:30	92	92	92	92	92	92	*	552
10:40-11:30	92	92	92	92	92	92	*	552
11:30-14:00	*	*	*	*	*	*	*	*
14:00-14:50	92	92	46	92	92	46	*	460
15:00-15:50	92	92	46	92	92	46	*	460
16:10-17:00	92	92	0	0	0	0	*	184
17:00-18:00	0	0	0	0	0	0	*	0
Total Classroom Hours	644	644	460	552	552	460	*	3,312
Total Available Classroom Hours	736	736	736	736	736	736	*	4,416
% Room Utilization	88	88	63	75	75	63	*	75

NOTES:

CLASSROOM UTILIZATION

Institution: Comprehensive University
Total Classrooms: 71 laboratories

Time Period	Classrooms in Use							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
07:30-08:20	71	71	71	71	71	71	*	426
08:30-09:20	71	71	71	71	71	71	*	426
09:40-10:30	71	71	71	71	71	71	*	426
10:40-11:30	71	71	71	71	71	71	*	426
11:30-14:00	*	*	*	*	*	*	*	*
14:00-14:50	71	71	35	71	71	35	*	354
15:00-15:50	71	71	35	71	71	35	*	354
16:10-17:00	0	0	0	0	0	0	*	0
17:00-18:00	0	0	0	0	0	0	*	0
Total Classroom Hours	426	426	354	426	426	354	*	2,412
Total Available Classroom Hours	568	568	568	568	568	568	*	3,408
% Room Utilization	75	75	62	75	75	62	*	71

NOTES:

ANNEX F
Table F.2

ANNEX F
Table F.3

CLASSROOM UTILIZATION

Institution: Teachers College
Total Classrooms: 52 academic classrooms

Time Period	Classrooms in Use							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
08:00-08:50	52	52	52	52	52	52	Adults	312
09:00-09:50	52	52	52	52	52	52	Adults	312
10:10-11:00	52	52	52	52	52	52	Adults	312
11:00-12:00	26	26	26	26	26	52	Adults	182
12:00-13:30	*	*	*	*	*	*	Adults	*
13:30-14:20	39	39	39	0	39	0	Adults	156
14:30-15:20	39	39	39	0	39	0	Adults	156
15:30-16:20	39	39	39	0	39	0	Adults	156
19:00-19:50	20	20	20	20	20	20	Adults	120
20:00-20:50	20	20	20	20	20	20	Adults	120
Total Classroom Hours	339	339	339	222	339	248	*	1,826
Total Available Classroom Hours	468	468	468	468	468	468	*	2,808
% Room Utilization	72	72	72	47	72	53	*	65

NOTES:

(1) Number of classrooms in use based upon faculty estimates: detailed data not available.

(2) Laboratories are normally used only during afternoon periods (13:30-14:20 and 14:30-15:20).

ANNEX F
Table F.4

CLASSROOM UTILIZATION

Institution: University of Technology
Total Classrooms: 130 academic classrooms

Time Period	Classrooms in Use							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Total
07:30-08:20	130	130	130	130	130	130	*	780
08:30-09:20	130	130	130	130	130	130	*	780
09:40-10:30	130	130	130	130	130	130	*	780
10:40-11:30	130	130	130	130	130	130	*	780
11:30-13:30	*	*	*	*	*	*	*	*
13:30-14:20	62	56	28	63	62	41	*	312
14:30-15:20	62	56	28	63	62	41	*	312
15:30-16:20	41	40	22	47	48	23	*	221
16:30-17:20	41	40	22	47	48	23	*	221
Total Classroom Hours	726	712	620	740	740	648	*	4,186
Total Available Classroom Hours	1040	1040	1040	1040	1040	1040	*	6,240
% Room Utilization	69.8	68.5	59.6	71.2	71.2	62.3	*	67.1

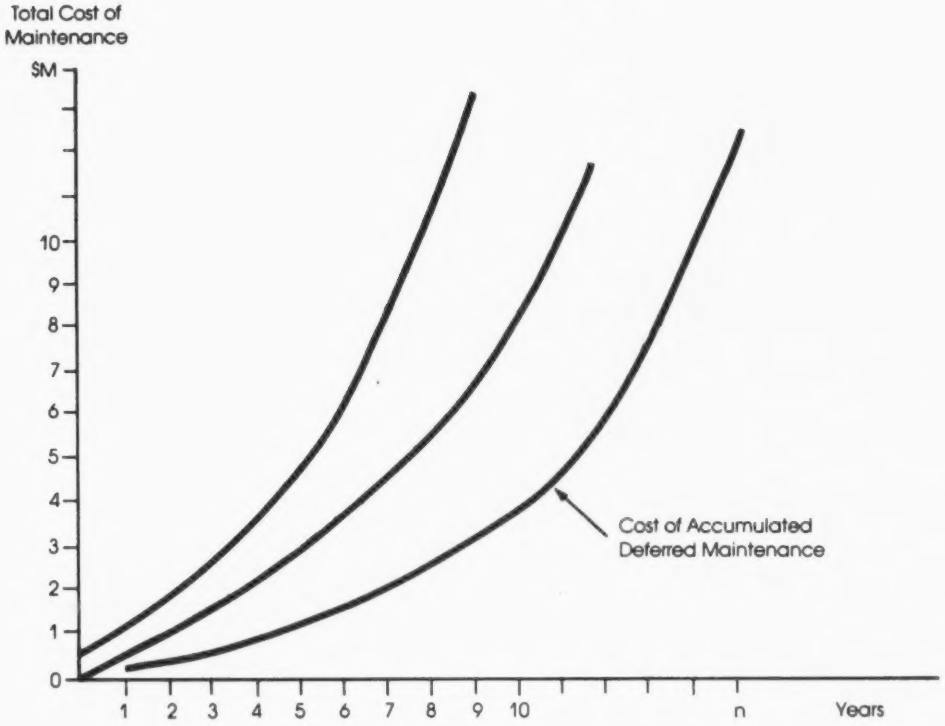
NOTES:

(1) Classrooms are fully occupied in the morning. Only about 50% are occupied in the afternoon. Others are used for self study by students.

(2) In the evening an average of 20 classrooms are used for evening students. Others are open for self study by students.

ANNEX G

Deferred Maintenance Costs[a,b]



[a] The actual cost of accumulated deferred maintenance would depend upon the specific items to be maintained. Therefore three typical curves are shown.

[b] Reference Kaiser, H., "The Cost of Deferring Maintenance" in Facilities Management: A Manual for Plant Administrators, Association of Physical Plant Administrators of Universities & Colleges, Alexandria, Virginia, 1984

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The World Bank

Headquarters
1818 H Street, N.W.
Washington, D.C. 20433, U.S.A.

Telephone: (202) 477-1234
Telex: WUI 64145 WORLDBANK
RCA 248423 WORLDBK
Cable Address: INTBAFRAD
WASHINGTONDC

European Office
66, avenue d'Iéna
75116 Paris, France

Telephone: (1)
47.23.54.21
Telex: 842-620628

Tokyo Office
Kokusai Building
1-1 Marunouchi 3-chome
Chiyoda-ku, Tokyo 100, Japan

Telephone: (03) 214-5001
Telex: 781-26838